Aleutians East Borough
Coastal Management Plan

Public Review Draft
June 2005

Chapter 6: Resource Inventory and Analysis Supplement

6.1 Introduction

This chapter supplements the resource inventories and analyses in previous documents. While the previous documents are incorporated into this revision of the Aleutians East Borough (AEB) coastal management plan (CMP), this chapter has two primary purposes. First, this chapter provides backup for areas designated under 11 AAC 114.250 and for the enforceable policies of the AEB (11 AAC 114.270). Second, this chapter summarizes scientific and local knowledge that has been documented since the original resource inventories and analyses were written.

Rather than separate the resource inventory and analysis into different chapters, the update discusses these elements by topic. The discussions begin with a summary of area designations, if any, followed by resource inventory and resource analysis information.

The AEB includes about 15,000 square miles of the lower Alaska Peninsula and islands of the Aleutians, most of which are in the coastal zone. There area 6 communities in the borough: Sand Point, King Cove, False Pass, Cold Bay, Nelson Lagoon, and Akutan. The AEB has a year-round population of over 2,500 with a large seasonal influx for seafood processing.

Weather patterns influenced by the confluence of the Arctic influences of the Bering Sea with the warmer waters of the Pacific Ocean: heavy participation, frequent fog, high winds and moderate temperatures.

Commercial fishing provides the backbone of the AEB's economy. During the 1990s, a combination of low availability of salmon stocks, low prices, and poor fishing weather converged to make crisis in the commercial fishing industry.

6.2 Previous Resource Inventories and Analyses

Information for the resource inventory and analysis for the AEB CMP is contained in several documents:

- Volume 1, Aleutians East Coastal Resource Service Area Conceptually Approved Coastal Management Plan, July 1985.
- Volume II, Resource Inventory for the Aleutians East Coastal Resource Service Area, April 1984.

- Volume III, An Analysis of Potential Development and Environmental Sensitivity in the Aleutians East CRSA, July 1985.
- 1992 Plan Revision to include areas of the AEB outside of the CRSA boundaries with supplemental resource inventory and analyses for Port Heiden/Stepovak Bay Area and the Kreniizin Islands and Akutan Area.

Table 6-1: Aleutians East Resource Maps

Table	Map
1	Coastal Area Boundary and Special Use Areas
A	Coastal Habitats
B	Geology and Natural Hazards
C	Oil, Gas and Minerals
D	Marine Fish and Shellfish
E	Anadromous and Freshwater Fish
F	Marine and Terrestrial Mammals
G	Seabirds, Waterfowl and Shorebirds
H	Salmon, Herring and Crab Fisheries Grounds and Processing Locations
I	Groundfish and Halibut Fishing Grounds
J	Archaeological and Historical Sites
K	Community Plan and Facilities
L	Land Status
M	Subsistence, Sport Fishing and Recreation

Source: 1984 CMP Volume II 1984 (Maps A-M) and 1985 boundary map (Map 1).

6.3 Requirements of the Resource Inventory and Analysis

Coastal district plans must include both a resource inventory and a resource analysis in their plans. Simply stated, the resource inventory describes major land and water uses, natural resources, cultural resources, and land ownership. The resource analysis includes a discussion of demands on coastal resources and habitats, conflicting uses and sensitivity of uses and resources to development impacts. More specific requirements for these plan elements are discussed below.

6.3.1 Resource Inventory Requirements

The resource inventory information in this chapter updates information about coastal resources and uses as well as meeting new requirements resulting from legislation passed in 2003 and the implementing regulations. The Alaska Coastal Management Program (ACMP) plan revision regulations require that plans include resource inventory information on the following subjects:

- Natural resources (fish and wildlife, water, wetlands, soils, minerals, forests, and habitats),
- Cultural, historic and archaeological resources,
- Resources important to subsistence uses, and
- Recreation resources [11 AAC 114.230(b)].

This chapter provides the following information for these topic areas:

1) Summary of findings from **recent studies** about coastal uses and resources,
2) **Local knowledge** [11 AAC 114.240(d)],
3) **Background for the enforceable policies** [11 AAC 114.270(a)], and
4) **Descriptions or maps of**:
   - major land or water uses,
   - major land ownership, and
   - areas designated under 11 AAC 114.250 [11 AAC 114.270(h)(1)(B)].

6.3.2 Resource Analysis Requirements

New analyses, including those based on local knowledge, have been added to this chapter regarding the impacts of uses and activities. Specifically, this chapter updates information about impacts to coastal resources, uses and habitats, including:

- **Demands:** present and reasonably foreseeable needs and demands for coastal habitats and resources,
- **Impacts:** reasonably foreseeable direct and indirect impacts of uses,
- **Suitability for Development:** suitability of habitats and resources for development, including natural hazard areas,
- **Sensitivity:** Sensitivity of habitats and resources for development, and
- **Conflicts:** potential conflicts among competing uses.

Changes to the resource analysis are also necessary to meet new requirements for enforceable policies that address a matter regulated or authorized by a state or federal agency. The resource analysis must provide justification for two parts of the "three-part test" in AS 26.40.070(a)(2)(C). Specifically, it must demonstrate that coastal uses or resources are:

- **Sensitive** to development [11 AAC 114.270(h)(1)(B)], and
- of a **unique concern** to the district [11 AAC 114.270(h)(1)(B)].[1]

The third part of the test, demonstration that the use or resource is in a defined portion of the coastal zone, must be met in the resource inventory.

The determination of whether a specific area is suitable for development must be made on a case-by-case basis based on available information, including information in the resource analysis regarding sensitivity of environments and effects of potential conflicting uses.

6.4 Subsistence

This section begins with a discussion of why the AEB has expertise in subsistence. It continues with a summary of areas designated for subsistence followed by the update to the resource inventory and resources analysis.

The AEB has expertise regarding subsistence uses and resources and for the potential of development activities to affect them. Its expertise stems from the relationship it has with subsistence-dependent communities in the borough and the local and traditional knowledge about

[1] The DNR has stated that the term "unique concern" may be interpreted as "of particular concern" to the district. In other words, the district must have a specific interest in the coastal resource or use.

subsistence of its residents. Thus, the AEB should be given due deference on subsistence uses because it represents the local subsistence users who have expertise on these resources.

Behnke and Sheinberg (1997) found that the word "subsistence"' has at least four different meanings in Alaska. First, subsistence refers to the activities of hunting, fishing and gathering by Alaska Natives and rural residents. Second, subsistence can relate to a legal context where priorities are established for use of fish and game. Third, as used by many Alaska Natives, subsistence is a way of life that includes cultural, social and economic factors. Fourth, the term subsistence is used by some to reflect use of resources for surviving a minimum economic existence. Changes to the ACMP regulations in 2004 adopted the definition of subsistence uses in Alaska Department of Fish and Game (11 AAC 112.900(38)).

6.4.1 Designated Subsistence Areas

The AEB has established all non-federal areas in the coastal zone as a subsistence area. Residents use all areas of the borough for subsistence hunting and fishing and plant collection. This designation is described in more detail in Chapter 7.

Although federal lands are not included in this designation, a project requiring a federal consistency determination or federal consistency certification "within or affecting land or water uses or natural resources of the coastal zone is subject to state standards in 11 AAC 112.200 – 11 AAC 112.990 and to applicable enforceable policies of a district coastal management plan approved under 11 AAC 114" (11 AAC 110.015).

6.4.2 Subsistence Resource Inventory

"Subsistence" in Alaska comprises a diverse set of localized systems of food production and distribution, representing relatively unique combinations of ecology, community, culture and economy. The mix of food species differs between traditional use areas due to ecological factors (Wolfe 2004). Subsistence, with ecological and cultural variances by location, includes terrestrial and aquatic hunting, fresh- and salt-water fishing, intertidal collecting, trapping, terrestrial gathering of plant resources, and the socioeconomic and cultural institutions which support the production, distribution, consumption, and perpetuation through time of an economic system based on the use of wild resources (Ellanna et al. 1985).

This resource inventory supplements the original resource inventory (Attachment B) and the 1992 amendment to the AEB coastal management plan (Attachment D).

6.4.2.1 Subsistence Use by Community

Salmon is the resource harvested in the greatest quantity by AEB residents, with large amounts reserved from commercial catches (Fall et al.1993; 1996). Other marine resources used include crabs, halibut, shrimp, seals, sea lions, clams, octopus, cod, sea urchins, and mussels (Schroeder et al.1987). Residents hunt waterfowl and land mammals extensively, and they also collect bird eggs.

Early summer marks the beginning of the salmon season, with chinook, sockeye and coho the most frequently harvested species. Salmon caught specifically for subsistence are taken from some traditional areas. In Sand Point, set gill nets are located near the village. Residents from False Pass generally use Urilia Bay or Thin Point for salmon fishing. King Cove residents use

beach seines in southside streams. Cold Bay residents fish in Mortenson's Lagoon (Schroeder et al. 1987).

Subsistence activities intensify after the commercial salmon season has ended, in early fall. Berries, including blueberries, salmonberries, mossberries, strawberries, and cranberries are picked and preserved for use throughout the year (Schroeder et al. 1987).
All communities of the lower Alaska Peninsula harvest waterfowl, a highly prized food resource. Hunting begins in September and continues throughout the fall, with October being the most productive month for waterfowl. Izembek Lagoon provides accessible, productive waterfowl hunting, for residents of Cold Bay as wells as other AEB residents who travel there for that purpose (Schroeder et al. 1987). Some occasional bird hunting activity takes place from March through July, and eggs are gathered in May and June (Fall et al. 1998).

ADFG researchers found that harvests of birds and bird eggs estimated in pounds of usable weight declined in Akutan between 1990-1991 and 1996-1997. They found an increase in bird and egg harvests between 1986-1987 and 1996-1997 in Nelson Lagoon, but a harvest level that stayed about the same in False Pass over the same period. During the 1996-1997 season, bird and egg harvests were estimated at 19.4 pounds per person at False Pass, 17.6 pounds per person at Nelson Lagoon, and 15.0 pounds per person in Akutan (Fall et al. 1998).

Land mammals harvested by AEB residents include caribou, moose and bison. Game is hunted during regulated seasons, primarily in Game Management Unit (GMU) 9D and GMU 10, which are within the AEB and also in some portions of GMU 9E, which is in the Lake and Peninsula Borough coastal management district. In 1992, moose hunting was closed in GMU 9D because of a lack of a harvestable surplus (Fall et al. 1993). In 2005, residents will be allowed one bull moose between December 15 and January 20, 2006 (ADFG/GMU website 2005).

The caribou inhabiting GMUs 9 and 10 are part of the Southern Alaska Peninsula herd, which declined drastically during the 1980s. The bag limit for caribou in this herd was four animals per hunter until 1988, when it was lowered to two. The total subsistence harvest for caribou by AEB residents in 1985-1986 was approximately 537 animals, and in 1986-1987 it was approximately 289 animals (Fall et al. 1990). In 1992, the bag limit was lowered to one bull (Fall et al. 1993). In 2005, the bag limit remains at one bull or one animal in subsections of GMU 9 and on Unimak Island in GMU 10. Elsewhere in GMU 10, there is no bag limit (ADFG/GMU website 2005).

Bison and cattle were brought to Popov Island in 1954, in an attempt to establish a ranch. The ranch failed, but bison survived as free-ranging animals on lands now owned by the Shumagin Corporation and lands within the Alaska Maritime National Wildlife Refuge. Some hunting of the bison by Sand Point residents has been allowed through a lottery (Fall et al. 1993).

Sea mammals, primarily harbor seals, are harvested by AEB residents. Seal oil is often used as a condiment with dried fish. Whale meat is utilized when available, usually from a whale that has washed up on the beach (Schroeder et al. 1987).

6.4.2.1.1 Sand Point

Sand Point is located on Humboldt Harbor on Popof Island, off the Alaska Peninsula, 570 air miles southwest of Anchorage. Home to the largest fishing fleet in the Aleutian Chain, Sand Point has a long history as a fishing community, and for a time it was a repair and supply center for gold mining.

Sand Point is characterized as self-sufficient and progressive, with commercial and subsistence fishing activities at the heart of the local culture. About 50% of the population is of Aleut decent, and many of the former residents of Pauloff Harbor and Unga now live in Sand Point. There is a large transient population for fishing and cannery work.

Trident Seafoods operates a major bottomfish, pollock, salmon and fish meal plant, and provides fuel and other services. Peter Pan Seafoods owns a storage and transfer station. Locals participate in subsistence consumption of fish and caribou.

ADFG studied subsistence use by Sand Point residents for the year 1992. The agency found that 94.2% of Sand Point households attempted to harvest at least one type of resource and that the households collectively utilized an average of 17.3 types of wild resources during the study year. There were 16 resources that were used by 50% or more households; sockeye salmon (used by 94.2% of the households), halibut (89.4%), berries (84.6%), coho salmon (81.7%), octopus (72.1%), chinook salmon (71.2%), ptarmigan (59.6%), pink salmon (59.6%), pacific cod (59.6%), chitons (57.7%), king crab (56.7%), bison (54.8%), chum salmon (54.8%), Tanner crab (53.8%), caribou (51.0%), and Dolly Varden (51.0%). Nine other resources were used by at least 25% of households: red rockfish (49.0%), wild plants other than berries (44.2%), Dungeness crab (38.5%), Canada geese (32.7%), mallard ducks (30.8%), steelhead (30.8 %), black rockfish (30.8%), gull eggs (26.9%), and sea urchins (26.0%) (Fall et al.1993).

Table 6-2. Subsistence Use by Sand Point Households in 1992

Resource	using	trying	harvesting	receiving	giving	Average Pounds	Per Capita Pounds
All Resources	100.00	94.20	94.20	95.20	69.20	759.81	255.73
Fish	100.00	81.70	78.80	82.70	55.80	568.89	191.47
Salmon	99.00	76.00	72.10	74.00	47.10	408.43	137.47
Non-Salmon Fish	97.10	74.00	72.10	63.50	38.50	160.46	54.01
Land Mammals	76.90	28.80	26.90	67.30	22.10	85.83	28.89
Large Land Mammals	69.20	21.20	17.30	64.40	21.20	68.65	23.11
Small Land Mammals	23.10	16.30	15.40	7.70	2.90	3.72	1.25
Feral Animals	15.40	3.80	3.80	12.50	2.90	13.46	4.53
Marine Mammals	25.00	12.50	9.60	17.30	9.60	13.96	4.70
Birds and Eggs	75.00	49.00	46.20	56.70	25.00	17.46	5.88
Marine Invertebrates	90.40	63.50	63.50	78.80	38.50	52.92	17.81
Vegetation	88.50	83.70	82.70	28.80	22.10	20.75	6.98

Source: ADFG Community Profile Database: http://www.subsistence.adfg.state.ak.us/

Wild resources were frequently and widely shared among Sand Point households in 1992. Ninety-five percent of households received at least one type of wild resource form another, and 69.2% gave away at least on resource to another household (Fall et all 1993).

Because the resources used by Sand Point residents (with the exception of salmon) are generally available year round, the seasonal round of subsistence activities depends on the availability of time and hunting and fishing regulations. Most of the marine resources inhabit the region all year, and they are customarily taken in small quantities as needed, although there are more concentrated harvest periods in late summer and early fall. Subsistence harvests of salmon, bottomfish, waterfowl and caribou occur at the end of summer. Ptarmigan hunting, chiton

gathering, subsistence crabbing and some caribou hunting are undertaken during the winter (Fall et al.1993).

Sand Point residents retained resources taken during commercial fish harvests, including commercially targeted species such as salmon, and those caught incidentally (bycatch). Sand Point commercial fishers removed about 57,738 pounds of wild resources (in usable weight) from their harvests for home use in 1992. This is approximately 95.3 pounds of wild foods per capita, and it constitutes approximately 37.3 % of the total subsistence harvest for the community that year (Fall et al.1993).

An estimated total of 17,509 pounds of land mammals were reported used in 1992, although only 28.8% of households had at least one member who hunted land mammals. About 67.3% of the households received mammal products from other households (Fall et al.1993).

Residents of Sand Point hunted birds in GMU 9D. Hunting was closed for some geese and swans, as well as spectacled and Steller's eiders. Egg collection was not allowed under federal law during the study period, while the federal regulatory framework was under review by the U.S. Fish and Wildlife Service. Ten kinds of ducks were used, with one third of the harvest comprised of mallards and slightly more than one fifth comprised of teals.

6.4.2.1.2 King Cove

King Cove is located on the south side of the Alaska Peninsula, on a sand spit fronting Deer Passage and Deer Island. It is 18 miles southeast of Cold Bay and 625 miles southwest of Anchorage. King Cove's economy depends almost completely on the year-round commercial fishing and seafood processing industries, the historic root of the community. The Peter Pan Seafoods facility is one of the largest cannery operations under one roof in Alaska. Up to 500 non-residents are brought up to work in the cannery as needed. Salmon, caribou, geese and ptarmigan provide food sources.

Table 6-3 Subsistence Use by King Cove Households in 1992

Resource	using	trying	harvesting	receiving	giving	Average Pounds	Per Capita Pounds
All Resources	100.00	97.30	96.00	94.70	81.30	908.20	256.07
Fish	97.30	86.70	85.30	74.70	50.70	636.51	179.47
Salmon	96.00	84.00	82.70	52.00	40.00	485.11	136.78
Non-Salmon Fish	89.30	68.00	66.70	68.00	42.70	151.40	42.69
Land Mammals	68.00	32.00	26.70	56.00	21.30	139.61	39.36
Large Land Mammals	66.70	29.30	25.30	54.70	20.00	68.00	19.17
Small Land Mammals	9.30	10.70	9.30	4.00	4.00	1.61	0.45
Feral Animals	25.30	13.30	13.30	14.70	10.70	70.00	19.74
Marine Mammals	25.30	13.30	13.30	16.00	9.30	7.47	2.11
Birds and Eggs	73.30	61.30	56.00	44.00	26.70	32.84	9.26
Marine Invertebrates	94.70	57.30	57.30	85.30	42.70	61.39	17.31
Vegetation	90.70	85.30	85.30	32.00	41.30	30.37	8.56

Source: ADFG Community Profile Database: http://www.subsistence.adfg.state.ak.us/

King Cove hunters utilize the valleys north and east of the community for caribou hunting. The flat areas at the head of Pavalof Bay are also extensively used. Caribou are occasionally hunted

from skiffs at the water's edge. Waterfowl are hunted at Morzhovoi and at Kinzaroff Lagoon (Schroeder et al.1987).

6.4.2.1.3 False Pass

False Pass, the only permanent community on Unimak Island, is on the eastern shore of the island along a strait connecting the Pacific Gulf of Alaska to the Bering Sea. It is 646 air miles southwest of Anchorage. The name False Pass is derived from the fact that the Bering Sea side of the strait is extremely shallow and cannot accommodate large vessels. The area was originally settled by a homesteader in the early 1900s, and it grew with the establishment of a cannery in 1917. Fishing, fish processing and subsistence activities are the mainstays of the lifestyle.

The local economy is driven by commercial salmon fishing and fishing services. False Pass is an important refueling stop for Bristol Bay and Bering Sea fishing fleets. Cash income is supplemented by subsistence hunting and fishing. Residents use salmon, halibut, geese, caribou, seals and wild cattle on Sanak Island are utilized.

All households in the community participated in subsistence harvests, according to a 1987-1988 ADFG study. Late spring, summer and early fall were the most productive times for resource harvests. The average household used 22.6 kinds of wild resources, for a total household average of 1,299.4 pounds for the year. This was equivalent to a per capita harvest of 412.5 pounds. Subsistence harvests in False Pass are similar in size, scope and composition to those of other smaller, predominately Alaska Native communities of the region, such as Akutan, Nikolski and Atka. The subsistence harvest is larger and more diverse than those of the larger communities of the region, such as Sand Point, king Cove and Unalaska. As is typical in the region, a significant percentage of the resources used (30.8%) were removed from commercial catches (Fall et al. 1996).

Table 6-4. Subsistence Use by False Pass Households in 1988

Resource	using	Trying	harvesting	receiving	giving	Average Pounds	Per Capita Pounds
All Resources	100.00	100.00	100.00	100.00	95.00	1299.37	412.51
Fish	100.00	80.00	80.00	95.00	90.00	798.79	253.59
Salmon	100.00	65.00	65.00	80.00	60.00	608.40	193.15
Non-Salmon Fish	95.00	70.00	70.00	75.00	75.00	190.38	60.44
Land Mammals	90.00	50.00	40.00	85.00	35.00	250.00	79.37
Large Land Mammals	90.00	50.00	35.00	85.00	35.00	232.50	73.81
Small Land Mammals	15.00	15.00	15.00	0.00	5.00	0.00	0.00
Feral Animals	15.00	5.00	5.00	10.00	5.00	17.50	5.56
Marine Mammals	60.00	30.00	30.00	55.00	30.00	79.70	25.30
Birds and Eggs	90.00	75.00	70.00	75.00	60.00	57.52	18.25
Marine Invertebrates	100.00	80.00	80.00	90.00	70.00	73.19	23.23
Vegetation	100.00	100.00	100.00	50.00	50.00	40.18	12.76

Source: ADFG Community Profile Database: http://www.subsistence.adfg.state.ak.us/

For the year 1987-1988, salmon constituted the largest portion of the total harvest (46.8%), followed by land mammals (mostly caribou) (19.2%), fish other than salmon (halibut, cod, Dolly Varden) (14.7%), marine mammals (harbor seal, beach-salvaged gray whale) (6.1%), marine invertebrates (octopus, clams, crab, chitons) (5.6%), birds and eggs (ptarmigan, waterfowl, gull eggs) (4.4%), and wild plants (3.1%) (Fall et al.1996).

Sharing of wild foods between households was extremely common in False Pass; every household received gifts of wild foods and 95% shared with other households. In 1987-1988, 30% of the False Pass households harvested 78% of the community's total harvest of wild foods. These highly productive households were likely to be involved in commercial fishing, be larger than average, and own boats and smokehouses (Fall et al.1996).

Marine invertebrates are commonly utilized species in False Pass. In 1987-1988, residents used at least 13 kinds of marine invertebrates, especially octopus (90.0 %), chitons ("bidarkies") (85%) and king crab (75.0%). Octopus use was estimated at 111 animals per household, for a mean harvest of 20.2 pounds per household (6.4 pounds per capita). Chitons were the only marine invertebrate species more widely used than octopus, at 22.5 pounds per household (Fall et al. 1996).

6.4.2.1.4 Akutan

Akutan is located on Akutan Island in the eastern Aleutians, one of the Krenitzin Islands of the Fox Island group. It is 35 miles east of Unalaska, and 766 air miles southwest of Anchorage. The community was a fur trading post, fish processing center and the only whaling station in the Aleutians, the latter ending in 1939. The community was evacuated during World War II.

Commercial fish processing dominates Akutan's cash-based economy, and many locals are seasonally employed. Subsistence is important to community residents; virtually all households harvest and/or consume wild foods. Subsistence foods include seal, salmon, herring, halibut, clams, feral cattle, and game birds. Akutan residents use marine mammals to a greater extent than do residents of any other AEB community. Nearly all households surveyed in 1992 utilized sea lions, and 78.6% used harbor seals, although the harvesting was undertaken by only 28.6% of the households (Wolfe and Mishler 1993).

Table 6-5: Subsistence Use by Akutan Households in 1990

Resource	using	trying	harvesting	Receiving	giving	Average Pounds	Per Capita Pounds
All Resources	100.00	96.00	96.00	100.00	92.00	1528.95	466.14
Fish	100.00	92.00	92.00	96.00	88.00	868.41	264.76
Salmon	96.00	76.00	76.00	84.00	64.00	398.04	121.35
Non-Salmon Fish	100.00	92.00	92.00	92.00	76.00	470.37	143.40
Land Mammals	72.00	28.00	20.00	64.00	24.00	91.04	27.75
Large Land Mammals	36.00	0.00	0.00	36.00	0.00	0.00	0.00
Small Land Mammals	12.00	12.00	8.00	4.00	4.00	0.72	0.22
Feral Animals	64.00	24.00	20.00	56.00	24.00	90.32	27.54
Marine Mammals	92.00	48.00	44.00	84.00	40.00	347.33	105.89
Birds and Eggs	92.00	72.00	68.00	84.00	52.00	92.96	28.34
Marine Invertebrates	88.00	68.00	64.00	72.00	56.00	92.45	28.19
Vegetation	100.00	96.00	96.00	64.00	52.00	36.77	11.21

Source: ADFG Community Profile Database: http://www.subsistence.adfg.state.ak.us/

Whales are not hunted by the community, but blubber is sometimes salvaged from whales that are found beached (ADFG Community Profile Database 2005).

6.4.2.1.5 Cold Bay

Cold Bay is located adjacent to the Izembek National Wildlife Refuge at the western end of the Alaska Peninsula. It lies 634 miles southwest of Anchorage, and 180 miles northeast of Unalaska. Cold Bay does not participate directly in the fishing industry, but it is an important transportation center. Because of its central location and long runways, Cold Bay serves as the regional center for air transportation on the Alaska Peninsula and as an international hub for private aircraft. Cold Bay also provides services and fuel for the fishing industry. State and federal government and airline support services provide the majority of local employment.

Cold Bay houses a number of federal offices with services focused on Aleutian transportation and wildlife protection. Subsistence and recreational fishing and hunting are practiced by local residents. Up to 70,000 Canada geese migrate through Cold Bay in the fall. Izembeck Lagoon contains the world's largest eelgrass beds and its feeding grounds support more than 100,000 brant geese during their spring and fall migrations.

6.4.2.1.6 Nelson Lagoon

Nelson Lagoon is located on the northern coast of the Alaska Peninsula, on a narrow sand spit that separates the lagoon from the Bering Sea. It is 580 miles southwest of Anchorage. Before becoming a year-round community, Nelson Lagoon was historically as an Unangan summer fish camp. The culture is focused on commercial fishing and subsistence activities. There is a strong community pride and loyalty among the residents, with a desire to maintain their lifestyle with slow, monitored growth and development that can be well managed by the residents.

Nelson Lagoon is situated in the middle of a rich and productive salmon fisheries area. Subsistence activities balance the seasonal nature of the fishery. Some trapping occurs. Residents are interested in developing a small seafood processing and cold storage facility.

Table 6-6: Subsistence Use by Nelson Lagoon Households in 1987

Resource	using	trying	harvesting	receiving	giving	Average Pounds	Per Capita Pounds
All Resources	100.00	100.00	100.00	100.00	100.00	937.59	253.92
Fish	92.30	92.30	92.30	38.50	76.90	333.42	90.29
Salmon	92.30	92.30	92.30	38.50	76.90	316.82	85.81
Non-Salmon Fish	53.80	53.80	53.80	7.70	30.80	16.60	4.50
Land Mammals	92.30	69.20	61.50	76.90	38.50	480.00	130.00
Large Land Mammals	92.30	69.20	61.50	76.90	38.50	480.00	130.00
Small Land Mammals	7.70	7.70	7.70	0.00	0.00	0.00	0.00
Marine Mammals	7.70	7.70	7.70	0.00	0.00	4.31	1.17
Birds and Eggs	92.30	84.60	84.60	46.20	76.90	44.38	12.02
Marine Invertebrates	100.00	92.30	92.30	76.90	76.90	58.87	15.95
Vegetation	92.30	84.60	84.60	46.20	38.50	16.62	4.50

Source: ADFG Community Profile Database: http://www.subsistence.adfg.state.ak.us/

The historical annual harvest of caribou was about 70 animals during the 1980s, but harvests have been estimated to have been as high as 150 animals in the past. Caribou is an especially important resource to residents of Nelson Lagoon because of the community's remote location. Ordering meat is expensive, and there is a risk of spoilage. The major source of red meat in the community has been caribou with additional meat supplied by waterfowl and ptarmigan (Fall et al.1990).

6.4.3 Subsistence Resource Analysis

This resource analysis supplements the analyses in the 1985 plan (Attachment C) and the 1992 supplement to the coastal management plan (Attachment D). This supplement provides information from sources that was not available when the original inventory was completed. It addresses demands for coastal habitats and resources, potential impacts from development activities, suitability for development, and sensitivity of resources.

6.4.3.1 Unique Concern

Subsistence uses and resources are a unique concern to the district and its residents because of a longstanding tradition to gather food from the land and waters. For many residents, especially those in rural areas of the borough, subsistence provides an important contribution to their nutritional needs. As well, subsistence activities provide cultural sustenance for many people in the district. Activities that affect subsistence have the potential to have substantial effects to those people in the borough who depend on subsistence resources and the subsistence lifestyle.

Traditional foods provide important benefits to subsistence users. According to the Alaska Traditional Knowledge and Native Foods Database, over half of the protein, iron, vitamin B-12 and omega-3 fatty acids in the diet of some Alaska Natives comes from subsistence foods. Subsistence foods have nutritional benefits that make them preferable to many purchased foods because they are rich in many nutrients, low in fat, and contain more heart-healthy fats and less harmful fats than many non-Native foods. Alaska Natives eating subsistence foods have lower signs of diabetes and heart disease, and may help avoid cancer. Subsistence harvesting in the AEB requires great expenditure of energy, which has positive benefits for avoiding obesity. Harvesting, preparing, eating and sharing traditional foods contribute to social, cultural and spiritual well being (ISER 2005).

6.4.3.2 Competing Uses

Economic development is important to residents of the AEB because it provides jobs and wages. Development can also impact residents' utilization of wild foods. Almost every use and activity has the potential to conflict with subsistence uses and resources depending on the specific location of the activity, when it occurs and the magnitude and duration of the project. Subsistence effects either occur directly to fish and wildlife resources or when there is increased conflict between different users (Behnke and Sheinberg 1997).

Activities that can conflict with subsistence include oil and gas activities, mining, recreation and sport hunting and fishing, changes in availability or resources, overfishing, limitations to access, and pollutants.

Oil and Gas: An oil spill has the greatest potential to affect subsistence resources and uses. Other effects from oil and gas include effects to migration of fish and wildlife by noise or increased vessel traffic.

Mining: Mining and associated development may damage subsistence resources and disrupt subsistence uses by displacing habitat and by introducing contaminants into the environment and sediments into rivers and streams. Large projects attract new residents to the region who may become competition for subsistence resources.

Recreation and Sport Hunting and Fishing: Conflicts between subsistence uses and independent and commercial recreation can be a cause for concern. Any large development in the region that brings with it an influx of workers is likely to increase competition for wild fish and game, and particularly for the caribou that are traditional and critical parts of many AEB residents' diets. Unauthorized use of cabins or private property can result in other conflicts with subsistence users.

With increased harvest pressure from a larger population, restrictions may be placed on harvests to better manage the wild resources. More restrictive seasons, bag limits, and harvesting methods may reduce harvest efficiencies in ways that impact the subsistence harvesters' ability to produce wild foods to eat (Wolfe 2004). Competition between subsistence and non-subsistence users extends beyond the AEB. For instance, seabirds are an internationally shared resource. Birds being harvested in one area may be part of a breeding population of another country (Denlinger and Wohl 2001).

Changes in Availability: A reduction of one resource from any cause may result in an increase in the harvest of others. The crash in populations of Steller sea lions, and the declines in populations of Northern fur seals, harbor seals and sea otters are variously attributed to commercial fishing activities, nutritional deprivation, intentional harvesting, or at least in part to a shift in prey availability for orcas as a legacy of industrial whaling (Springer et al. 2003).

Overfishing: Overfishing of stocks of forage fish, or any activity that reduces the population of forage fish may have an impact on the significant seabird colonies that are used for subsistence. A lack of forage fish has been demonstrated to lower the reproductive performances of seabirds such as kittiwakes and murres (Hunt and Byrd 1999).

Direct or indirect competition for food with commercial fisheries may limit predator species from obtaining sufficient prey for growth, reproduction and survival (National Research Council 1996). This may, in turn, result in a reduction of a population important for subsistence, such as marine mammals.

Access: Access to subsistence on lands is a major concern of subsistence users. This issue will become more important as land transfers into private ownership or as undeveloped land becomes developed. It is especially important that effects to subsistence uses and resources be fairly considered when public land is being considered for sale or leased to private entities.

Pollutants: Industrial pollutants, oil spills, and long distance transport of pollutants all have the potential to affect subsistence. Persistent organic pollutants (POPs) travel over long distances. They are human-made organic compounds that are able to bioaccummulate in living organisms. They can travel long distances and tend to migrate to northern climates because of strong south-to-north air flows. Contaminants have been found in the fatty tissues of many northern species, including marine mammals. When humans consume animals contaminated by POPs, the chemicals accumulate in their bodies. Potential health effects from POPs include neurological, neurodevelopmental, reproductive, endocrinal, immune systems effects, and cancer.

6.5 Cultural, Historic and Archaeological Resources

This section begins with a description of areas designated as important for the study and understanding of history and prehistory followed by an update to the resource inventory and analysis.

6.5.1 Designated Areas for the Understanding of History and Prehistory

The AEB designates all non-federal land within its coastal zone as important to the study and understanding of historic and prehistoric resources. Archaeological resources have the potential to be found anywhere in the borough. The coastal zone boundary maps (Appendix J) illustrate the boundaries of the coastal zone and where federal lands are located. More information about designated areas may be found in Chapter 7.

Although federal lands are not included in this designation, a project requiring a federal consistency determination or federal consistency certification "within or affecting land or water uses or natural resources of the coastal zone is subject to state standards in 11 AAC 112.200 – 11 AAC 112.990 and to applicable enforceable policies of a district coastal management plan approved under 11 AAC 114" (11 AAC 110.015).

6.5.2 Cultural, Historic and Archaeological Resources Resource Inventory

Although there have not been extensive surveys completed in the region, the AEB has significant historic and archaeological resources. The Aleut, or Unangan people, have inhabited the area for thousands of years, and they developed a rich culture the depended on sea mammal hunting and fishing.

Today, the communities of Akutan, False Pass, and Nelson Lagoon are mostly composed of Aleuts. The communities of Sand Point and King Cove have more non-Natives, and Cold Bay residents are mostly non-Native. The communities with fish processing facilities have lead to a diverse population including Asian and Mexican workers. Officially recognized tribes under the 1934 Indian Reorganization Act include the Unga, Sanak and Eastern Aleutian Tribes.

6.5.2.1 Historical Periods

For the purposes of this historical overview, the historical periods have been divided into 4 categories: pre-contact, Russian period, American period, WWII, and current times.

Pre-contact: Before contact with Russians and European explorers, the Aleuts were organized into groups that were often in open conflict with each other. These groups formed alliances for defense against enemies or when attacking a common enemy. The people subsisted mostly on marine mammals, and local variation in subsistence patterns provided the basis for trade. The Aleuts manufactured goods, such as gut parkas, for trade with other areas. Subsistence activities revolved around marine mammals and fish. Kayaks (baidarkas) and umiak-type skin boats (baidaras) were used to hunt and fish. The Aleut people survived through periods of famine by changing subsistence use patterns and through innovation (Black et al. 1999).

The Aleuts established their settlements in strategic locations with protection from enemies, a gravel beach for landing skin-covered watercraft, and a protected bay. A class system characterized the Aleut society with high nobles, commoners and slaves established through heredity. The shape of Aleut visors, used when at sea, reflected the rank of the individual.

Russian Period: Beginning at the end of the 1750s, Russian fur traders expanded their territory to the area now within the AEB. Early contact with the Aleuts was contentious, and sometimes resulted in raids on ships and deaths of crews. Increased trade led to establishment of trading posts beginning in 1774 with a permanent trading post on Unalaska. Beads and iron goods were of interest to the Aleuts. Some boat captains forced Aleut men into service for the fur trade. Hostages were taught Russian and became interpreters.

The Russian period occurred under three charters. In 1799, the Russian government gave the newly reorganized Russian-American Company an imperial charter that gave them control over the fur trade in Alaska for 20 years. Aleut men continued to be forced to provide labor for the fur trade, and some of them were relocated from Krenitzin Islands to Kodiak, Yakutat and Sitka. Baranof was removed from office in 1818, and Aleut rights were established under the second charter. They were given the same rights as Russian peasants, and they had labor obligations similar to the military service requirements in Russia. Men were required to serve as laborers for 3 years. In 1824, residents of Sanak were moved to Bekfski. The third charter began in 1844. The fur trade expanded from sea otters to include fur seas and foxes.

American Period: The U.S. bought Alaska from Russia in 1867. Troops were stationed in Alaska for the first time. The Alaska Commercial Company continued trading posts on Akutan, Unga and Belkofski. Once U.S. took possession of Alaska, an influx of hunters from other nations came to harvest sea otters and fur seals. Practices by Russians to conserve populations, such as bag limits and rotation of hunting areas, were no longer practiced, and populations of marine mammals plummeted. Restrictions were imposed that allowed only Native hunters or those to Natives to continue hunting sea otters. In 1911, the first international convention that protected wildlife resulted in a ban on sea otter hunting.

Although provisions of the Treaty of Cession did not grant rights of citizenship to “the uncivilized native tribes,” a court case 30 years later granted them citizenship. The U.S. government, however, continued to treat Native people as wards of the government (Aleut Corporation 2004).

During 1884, the first Organic Act established provided direction for management of Alaska and rights of Native people. Sheldon Jackson was appointed the first General Agent for Education in 1885. He divided Alaska into “spheres of influence” among various religions, and the Aleutian region was assigned the Methodist Church. In 1912, Alaska was given territorial Status.

Other resource development followed the fur trade. Beginning in 1910, commercial fishing grew in importance, first for cod and then for salmon. Canneries were constructed on the Shumagin Islands, on Sanak and on the Alaska Peninsula.

A whaling station, financed by Norwegian investors, opened in Akutan in 1911. This was the only whaling station in the Aleutians.

The Russians introduced non-native foxes to many of the islands, and Aleut trappers were paid for furs. The practice was not continued by the Americans until after the sea otters declined in the 1880s. Farming continued until WWII.

Cattle farming began during Russian occupation, and it continued on several islands for many years. Cattle was introduced to the islands of Sanak, Unga and Simeonof, although the U.S. Fish and Wildlife Service eliminated them from Simeonof Island in 1980s. Cattle on Sanak Island are

the property of the Sanak Corporation. Bison were introduced to Popov Island in the 1930s and herds continue to roam the island today.

Mining began during the Russians rule with coal mined from Unga Island between 1841 and 1867. The coal was of poor quality, and it was not suitable for export. Coal from a mine at Herendeen Bay was transported to the Pacific side of the peninsula to supply fuel for steam-powered boats. Additionally, a sulphur mine on Akun operated for a while. Three mines operated on Unga Island. The Apollo gold mine began operation in 1886 and closed in 1904.

WWII: The Second World War brought many changes to the Aleutians. King Cove became an important staging area for supplies to Cold Bay, and in providing supplies to Russian ships as part of the lend-lease program. Construction began on the airfield in Cold Bay in 1940 that would become a strategic air base known as Fort Randall. As part of the lend-lease program, boats were sailed from Cold Bay to Vladivostok. Soviet soldiers were stationed at Cold Bay sailed ships to Vladivostok, and the officer's club, known as the Volcano Club, was added to the National Register of Historic places. Sand Point also became an important military hub.

During WWII, residents of areas Unimak Island and west were evacuated from the area. Akutan residents were relocated to Ketchikan, but poor living conditions led to the deaths of some of those interned. After the war, residents returned to Akutan and found their homes damaged and possessions missing. The forced relocation of people from of Biorka, Kashega and Makushin to Akutan added to the tensions in the community.

The military importance of Cold Bay continued after the war. It was a refueling stop during the Korean War, and it provided an important refueling stop during Vietnam for the Flying Tigers.

Current Period: Beginning in the early 1970s, a number of changes resulted in expanded local control. In 1971, passage of the Alaska Native Claims Act established the Native corporations, including the regional Aleut Corporation and village corporations. In addition to a cash settlement, the corporations were given the right to select land.

As a result of a court decision in 1975, known as the Molly Hootch case, local schools were established in many Alaska communities. Prior to the court case, many area children were sent out of the region to boarding schools.

After passage of the Alaska Coastal Management Act in 1977, the residents of the area formed a Coastal Resource Service Area. This allowed the residents to assert some degree of local control over how the areas coastal resources and uses were managed. The plan was approved in 1985.

In 1987, the AEB formed. It included the area of the CRSA plus areas to the east and west. The formation of the borough gave more local control to the residents of the area through Title 29 and taxation powers.

The passage of the Alaska National Interest Lands Conservation Act (ANILCA) in 1980 had an important effect on residents of the AEB. In addition to designating conservation units, such as the wildlife refuges, Section 802 gave rights to subsistence resources. As of July 1, 1990, the federal government took over management of subsistence on all federal lands in Alaska. The use is managed through federal subsistence boards.

6.5.2.2 Cultural Resources

There have not been many archaeological surveys in the AEB. Only several major sites have been investigated by professional archeologists. The Hot Spring Site between Port Moller and Herendeen Bay was discovered in 1928, and it was occupied between 1500 – 1000 B.C. until 1500 A.D. Other sites have been investigated in the Izembek National Wildlife Refuge, the Krenitzin Islands, and a burial cave on Unga Island. In some areas, such as the Sanak Islands, no archaeological work has ever been conducted (Black et al. 1999).

Historic resources include abandoned cannery sites, fishing stations, trapping and hunting cabins, churches, and WWII artifacts. Over 75 shipwrecks are located within the borough (Black et al. 1999).

6.5.3 Cultural, Historic and Archaeological Resources Resource Analysis

The resource analysis begins with a description of why these resources are a unique concern to the district. It continues with a discussion of why cultural, historic and archaeological resources are sensitive to development and ends with a discussion of conflicting uses.

6.5.3.1 Unique Concern

Cultural, historic and archaeological resources are a unique concern to the AEB and its people, because it defines who they are. These resources are important on a personal and family basis as well as a cultural basis. An individual's or family's identity is closely related to their connection to the Aleut culture.

6.5.3.2 Sensitivity to Development

Archaeological and historic resources are extremely sensitive to development. Any ground-disturbing activity has the potential to destroy or disrupt such sites. Even minor disturbance to a site can have serious consequences because the context of where an artifact is found can provide important information to archaeologists and historians.

The way of life in the AEB is also sensitive to development. Large-scale development can have social and cultural effect by affecting access to subsistence resources, increasing competition for subsistence resources, alteration of wildlife behavior through noise, and disruptions to village life.

6.5.3.3 Conflicting Uses

Any activity that has the potential to alter or destroy historic or archaeological resources is a potentially conflicting use. The following discussion addresses three common concerns.

- **Undiscovered Sites:** The inadvertent destruction of a site that has not yet been discovered is an important concern.
- **Removal of Artifacts:** The purposeful removal of artifacts from archaeological sites can destroy valuable information and insights about previous inhabitants.
- **Vandalism:** Destruction of historic or archaeological sites can also have serious consequences to the resources.

- **Trespass:** Visitors may unknowingly trespass on private lands or use areas that are avoided by Native people due to spiritual significance.
- **Loss of Culture:** Cultural loss occurs when oral traditions are not passed on through generations. It also occurs when young people do not learn the traditional languages.

A number of practices can minimize impacts of conflicting uses. Requirements for archaeological surveys or consultation before development can reduce the instances of damage to sites. Establishment of museums in individual communities gives local people a sense of pride, provides a safe repository for artifacts, and promotes tourism. The development of brochures can emphasize the importance of preserving cultural, historic and archaeological resources.

6.6 Biological Resources

This section supplements the 1984 and 1992 resource inventories and analyses. It begins with an explanation of areas designated by the AEB as important habitat areas. It continues with an update to the resource inventory and the resource analysis.

6.6.1 Designated Important Habitat Areas

The AEB designates the following areas as important habitat areas under 11 AAC 114.250, excluding federal lands. Although federal lands are not included in this designation, a project requiring a federal consistency determination or federal consistency certification "within or affecting land or water uses or natural resources of the coastal zone is subject to state standards in 11 AAC 112.200 – 11 AAC 112.990 and to applicable enforceable policies of a district coastal management plan approved under 11 AAC 114" (11 AAC 110.015).

- Units within the AEB designated for habitat management in the 2005 Bristol Bay Area Plan because of concentrations of fish and wildlife or special habitat features, including units R18-02, R18T-01, R18T-02, R19-01, R19T-01, R21T-01, R21T-02, R21T-03, R21T-05, and R22T-01. These habitats have been identified by DNR to have extraordinary attributes, and many of them support large concentrations of fish, birds and land mammals. Appendix H includes a map of these units.

- Areas identified for the following resources on Most Environmentally Sensitive Area (MESA) maps 25a and 25b (Port Moller-Nelson Lagoon), 26a and 26 b (Izembek Lagoon), 28a and 28b (Unimak Pass-Krentizin Islands), 35 (Sandman Reefs), and 36 (Shumagin Islands): Harbor seal haulout concentrations, sea lion haulout, sea lion rookeries, walrus haulout concentrations, sea otter concentrations, seabird colonies, waterfowl spring and fall concentrations, waterfowl fall concentrations, waterfowl nesting concentrations, waterfall water concentrations, waterfowl molting concentrations, herring spawning concentrations, brown bear feeding concentrations, brown bear spring concentrations, and razor clam concentrations (Appendix F).

- Areas identified for the following sensitive resources in the Coastal Resources Inventory and Environmentally Sensitivity Maps 1 – 13: alcid and pelagic bird, diving bird, gull and tern, shorebird, waterfowl, nesting colonies, fish, invertebrate, bivalve, crab, plant, eelgrass, pinniped, sea otter, haulout site, and multi-group (Appendix G).

- All anadromous fish waters identified in the ADFG Fish Distribution Database Atlas (Appendix I).

- The areas identified as special use areas on Map 1 (Appendix E) including the Unimak Pass, Bechevin Bay, Izembek Lagoon, Pavlof/Canoe Bay, Nelson Lagoon, and Port Moller/Herendeen Bay special use areas.

Additional information about these designations is included in Chapter 7.

6.6.2 Biological Resources Resource Inventory

This section supplements information previous resource inventories. Information about habitats and fish and wildlife sources were mapped in the 1984 Resource Maps (See Table 6-1 and Appendix E). Detailed descriptions of coastal habitats in the AEB may be found one pages 1-3 of the Resource Inventory for the Aleutians East Coastal Resource Service Area (1985).

The highly varied coastline of the 1,050-mile long Aleutian Island chain offers a wide variety of environmental niches. The area from Port Moller south through the northern tip of Unimak Island is the lower Alaska Peninsula. It is a relatively narrow land mass with several large bays protruding inland from both the Pacific Ocean and the Bering Sea coastlines. Several islands are located along the Pacific side. On the western side of the peninsula, swamps and moist tundra characterize the landscape. On the eastern side, volcanoes as high as 8,000 feet occur along the coastline (Schroeder et al. 1987).

Bird rookeries, reefs thickly encrusted with intertidal life, and beaches with driftwood accumulations and marine waters provided resources that enabled people to live in this region for thousands of years. Other important features included sea mammal haulouts, estuaries, and salmon streams and kelp beds thick with fish, sea otters and sea birds.

Upland meadows provided abundant berries and other plant foods during a short but productive growing season. The abundant food supply provided the foundation for substantial human populations that probably exceeded that of the modern day Aleutian region.

Life histories for the fish and wildlife resources of the AEB are detailed in Section II: Biological Descriptions of the Aleutians East AEB in the Resource Inventory for the Aleutians East Coastal Resource Service Area (1985) as follows:

- Chapter 4: Marine Fish and Invertebrates, pp. 7-9,
- Chapter 5: Anadromous and Freshwater Fish, pp. 9-11,
- Chapter 6: Marine Mammals, pp. 11-14, and
- Chapter 7: Birds, pp. 14-16.

The following sections describe the status and trends for fish and wildlife species important to the residents of the AEB and for which significant new information has been developed since 1985.

6.6.2.1 Marine Fish and Invertebrates

A discussion of groundfish in the marine environment of the AEB can be found at discussion on commercial fisheries in Section 6.7. Crab abundance has trended low for many years. The mature biomass of Bristol Bay red king crab was highest in 1980, but declined and has remained relatively low. Eastern Bering Sea tanner crab abundance was high in the early 1980s and from 1988 to 1992. The population has declined since then and currently continues to decrease. The

stock is considered to be overfished and the fishery has been closed since 1996. Similarly, the mature biomass of Eastern Bering Sea snow crab was moderate to high in the early 1980s and from 1987 to 1997. The biomass declined sharply from 1998 to 1999 and the stock is considered overfished. Fishery management plans have been developed for all three species in order to rebuild the stocks and create sustainable fisheries (Otto and Turnock 2004).

6.6.2.2 Anadromous and Freshwater Fish

The ADFG determined that salmon stocks of the South Alaska Peninsula, North Alaska Peninsula and Bristol Bay were all healthy in 1999. This determination of healthy status is based on the previous 3 to 5 years experiencing escapement being within the escapement range. Researchers found that with few exceptions (none of which were in the area of the AEB), the state's salmon runs were in excellent shape, due to good fisheries management and a pristine environment. Researchers cautioned that run sizes are determined by oceanographic conditions that are poorly understood and impossible to manage (Kruse et al. 1999).

6.6.2.3 Marine Mammals

The people of the Aleutians depended heavily on marine mammals during pre-contact times. Although archaeological evidence indicates that some communities hunted whales, this practice does not continue. The Aleutian Islands and Alaska Peninsula region, however, provided important whaling grounds during the post-contact period. Large whales were extensively exploited, almost to extinction, inculding the North Pacific right whale, fin, sei, blue, humpback and sperm whales. Minke whales were depleted to a lesser extent. Two recent summer surveys have indicated that humpback whales were abundant in the historical whaling grounds north of the eastern Aleutian Islands, and fin whales were abundant in one of the two primary whaling area, Port Hobron, south of the Alaska Peninsula. There were no sightings of either blue or North Pacific right whales. Blue whales have been sighted in the Gulf of Alaska and near Prince William Sound in 2004 (Sinclair 2004).

Steller sea lions were listed as "threatened" species under the Endangered Species Act in 1990. Separate stocks of the species were later identified, and the Western Stock, which occurs westward from 144° longitude (approximately Cape Suckling, east of Prince William Sound) to Japan and Russia was listed as "endangered" in 1997. Using newer survey techniques, NMFS calculated that the population counted in 2004 shows an increase of approximately 6-7% between 2002 and 2004. In 2004, there were a total of 28,730 non-pup Steller sea lions counted on 262 sites surveyed periodically since the mid-1980s. These sites are known as "trend sites." Although the distribution showed a stabilization of the population in the Steller sea lion population in the central Aleutians, it dipped between 1998 and 2002, followed by a slight increase in 2004. Trend site counts decreased sharply in central and eastern Gulf of Alaska through 1998, increased after 1998 in the eastern Gulf of Alaska (GOA), but continued to decline in the central GOA. These trends are under study by NMFS (Sinclair 2004).

Harbor seals counted over the period from 1993-2001 showed an increase of 6.6% per year over that period in the GOA, which was the first documented increase in harbor seals in the GOA. Trend counts have been conducted in Bristol Bay only between 1998 and 2001, with inconclusive results. Since spotted seals occur in the same waters and the species cannot be distinguished in aerial surveys, numbers are difficult to count (Sinclair 2004).

Sea otter populations are estimated to have been as many as 300,000, distributed across the North Pacific Rim. After 150 years of commercial harvest for their fur, their numbers sank to an estimated 2,000 in a small number of remnant colonies. After gaining protection under the 1911 Fur Seal Treaty, sea otter numbers increased and they re-colonized much of their historic range. From estimates made during 2000-2002, researchers believe that the total Southwest Alaska stock of sea otter numbers between 33,203 and 41,474. The Aleutian Islands had been home to the world's greatest concentration of sea otters, but had dramatically declined between 1965 and 2000. In fact, the U.S. Fish and Wildlife Service (USFWS) estimated that the population of the central Aleutian Islands had declined by 70% between 1992 and 2000. Declines of 93-94% were documented for the South Alaska Peninsula and declines of 27-49% were documented for the North Alaska Peninsula (NOAA/OPR 2005).

Population increases were found in some areas as well, including the Port Moller/Nelson Lagoon area and the Alaska Peninsula from Castle Cape to Cape Douglas. However, those increases are insufficient to offset the declines observed over the past 10-15 years. The USFWS has listed the southwest Alaska Distinct Population Segment of the northern sea otter as endangered. The cause for the decline is unknown; subsistence harvests are considered to be too low to be a cause. Incidental take of sea otters by commercial fisheries is near zero and considered insignificant. Killer whale predation may play a role in the declines and requires further investigation (NOAA/OPR 2005).

Sea otters function as a keystone species, and play an important role in maintaining coastal ecosystems. The disappearance of sea otters would increase the populations of sea urchins, their primary prey, which would, in turn, have major impacts on kelp beds (NOAA/OPR 2005).

6.5.2.4 Terrestrial Mammals

Caribou are a primary subsistence resource for many residents of the AEB, and are also important to sport hunters. The Southern Alaska Peninsula Caribou Herd has experienced fluctuations in their numbers since the early 1980s. The herd numbered an estimated 10,200 in late 1983, but was reduced to about 4,100 animals in 1987. Reasons for the decline included hunter harvests, predation, and low calf production, possibly because of poor range conditions. Hunting was curtailed by regulation, but the herd numbers have remained low, and the bag limit has been set correspondingly (Fall et al. 1990, ADFG/DWC 2005).

6.6.2.5 Birds

Extensive breeding colonies containing millions of seabirds occur on the Aleutian Islands, the Pribilof Islands and along portions of the Alaska Peninsula. The area is a major spring and fall staging area for migrating waterfowl and a permanent residence for some species. Major staging areas include Izembek Lagoon, Port Heiden and Nelson Lagoon (DEC/Contingency Plan 1999).

According to an interagency group of bird researchers, comparisons of historical and current information about the distribution of pelagic birds in Alaska waters cannot be made due to gaps in data. Recent efforts to address the gap in data include the introduction of stationery seabird surveys aboard longline and trawl fisheries research vessels in 2002.

Colonies of nesting seabirds have been surveyed. Along the coast of the north-central GOA, colonies are generally small, but occur in more than 850 locations. Larger colonies are found at the Barren and Semidi Island groups. Along the Alaska Peninsula, there are 261 colonies, and 144

are located in the Aleutian Islands. The colonies increase in size as they occur towards the west, and include several with over one million birds and two with more than three million birds. Large colonies of over three million birds are also found on the large islands of the Bering Sea. Yearly surveys show declining seabird populations in the Southeast Bering Sea (including the Pribilof Islands) and the GOA, but increasing trends in the Southwestern Bering Sea. (Fitzgerald et al. 2004).

Steller's eiders, diving ducks that feed on mussels in marine waters during the winter and insect larvae in freshwater ponds in the spring and summer, suffered as much as a 50% decline between the 1960s and the 1980s. The cause of the decline is unknown. Although the world population of the distinctively marked birds may number 150,000 to 200,000 individuals, the breeding population in Alaska is thought to be as low as 1,000 birds. In winter, most of the world's population of Steller's eiders range throughout the Alaska Peninsula and eastern Aleutian Islands (ADFG/DWC 2003). At certain times of the year 80% of the world's population of threatened Steller's eiders may be in the area around Nelson Lagoon.

Another eider species that occurs in the AEB is the spectacled eider. The majority of these birds nest in the Arctic and along the Yukon-Kuskokwim Delta and may winter along the Bering Sea. They have experienced a decline similar in time frame but less severe than the dramatic decline of the Steller's eider. Suspected causes of the decline include a combination of reduced food supplies, pollution, overharvest, lead shot poisoning, increased predation and other causes (ADFG/DWC 2003).

6.6.2.5 Vegetation

A number of rare plant species are located in the Aleutians Islands region as indicated in Table 6-7.

Table 6-7: Rare Plants Known from the Aleutians Subarea

Global Rank	State Rank	Scientific Name	Common Name
G1	S1	*Polysticum aleuticum*	Aleutian Shield Fern
G1	S1	*Saxifraga aleutica*	Aleutian Saxifrage
G1	S1	*Artemesia aleutica*	Aleutian Wormwood
G4T1T2Q	S1S2	*Artemesia globularia var lutea*	
G2	S2	*Draba aleutica*	Aleutian Rockcress
G2G3	S2S3	*Douglasia alaskana*	Alaska Rock Jasmine
G3	S1	*Claytonia arctica*	Arctic Spring Beauty
G5T3Q	S3	*Carex lenticularis var dolia*	Goose-grass sedge
G3G4	S2	*Eleocharis nitida*	Neat Spike-rush

Species Ranks Used by the Alaska Natural Heritage Program:

Species Global Rankings
G1 Critically imperiled globally (5 or fewer occurrences)
G2 Imperiled globally (6-20 occurrences)
G3 Rare or uncommon globally (21-100 occurrences)
G4 Apparently secure globally, but cause for long-term concern (usually more than 100 occurrences)
G5 Demonstrably secure globally

Species State Rankings
S1: Critically imperiled in state (5 or fewer occurrences)
S2 Imperiled in state (6-20 occurrences)
S3 Rare or uncommon in state (21-100 occurrences)
S4 Apparently secure in state, but with cause for long-term concern (usually more than 100 occurrences)
S5 Demonstrably secure in state

G#G# Rank of species uncertain, best described as a range between the two ranks
S#S# State rank of species uncertain, best described as a range between the two ranks
G#Q Taxonomically questionable
G#T# Global rank of species and global rank of the described variety or subspecies of the species
Source: Alaska Native Heritage Program 2005

6.6.2.7 Threatened and Endangered Species

There are at least 12 species located in the Aleutians region that are considered threatened or endangered. Table 6-8 lists these species.

Table 6-8: Threatened and Endangered Species in the Aleutians East Borough

Common Name	Scientific Name	Occurrence
Blue whale*	*Balaenoptera musculus*	Occasional migrant
Fin whale*	*Balaenoptera physalus*	Occasional migrant
Humpback whale*	*Megaptera novaengliae*	Occasional migrant
Kittlitz's Murrelet****	*Brachyramphus brevirostrus*	
Northern sea otter***	*Enhydra lutris kenyoni*	Resident
Pacific right whale*	*Balaena glacialis*	Occasional migrant
Sei whale*	*Balaenoptera borealis*	Occasional migrant
Sperm whale*	*Physeter catodon*	Occasional migrant
Steller sea lion*	*Eumetopias jubatus*	Resident
Short-tailed albatross*	*Diomedea albatrus*	Resident
Steller's eider**	*Polysticta fischeri*	Winter resident
Spectacled eider**	*Somateria fischeri*	Winter resident

*Endangered ** Threatened ***Proposed ****Candidate

Source: USFWS Endangered Species List

During the first 25 years of the Russian-American fur trade, overhunting of the Stellers sea cow resulted in its extinction. This manatee-like species grew up to 35 feet long, and it weighed 3.5 tons. First reported by Russian explorers in 1741, it was hunted to extinction by 1768.

6.6.3 Biological Resources Resource Analysis

This section supplements the 1984 and 1995 resource analyses. It begins with a discussion of why biological resources are a unique concern to the AEB and continues with a discussion of why these resources are sensitive to development. It ends with a discussion of conflicting uses and adverse impacts to biological resources, including habitat.

6.6.3.1 Unique Concern

Biological resources are a unique concern to the AEB and its residents for several reasons. Fish and wildlife species provide the backbone of the economy through commercial fishing and seafood processing. As well, fish and wildlife are a prime attraction for visitors to the region and its developing tourism base.

6.6.3.2 Sensitive Areas and Resources

Generally, biological resources are extremely sensitive to development. While certain species are more sensitive than other to development, all species have the potential to be adversely impacted by development activities in some way. The type of development activities, the location and duration of those activities, and the sensitivity of the species will determine the effects of a development. Species are often more sensitive to activities during specific life stages such as caribou and moose calving, fish spawning, and bird nesting.

6.6.3.3 Conflicting Uses and Effects to Biological Resources

This part of the resource analysis addresses uses that can conflict with fish, wildlife and plant life, including habitats. More in-depth discussions of these effects may be found in the 1984 and 1992 resource analyses.

Disruption to Seabird Nesting Sites: Most seabirds use land only to nest and raise their chicks. The time they are on land is considered a critical stage in their life history when they are extremely vulnerable. Nesting can be disrupted by loud noises or by disturbance by humans, dogs and introduced species such as rats. Successful nesting requires a constant temperature, and when exposed to the elements, eggs my die from either being too warm or too cold depending on the conditions. Some seabirds nest in holes in the ground which can collapse from the weight of hikers.

Bear-Human Interactions: Human interactions with bears can affect their behavior and lead to fatalities. For example, increased fishing and hunting in remote areas can result in bear attacks that result in the death of either the bear or the humans. Purposely feeding bears or creating an attractive nuisance from landfills or inadequate storage of trash can create “garbage bears.” Once a bear become habituated to garbage it may be necessary to destroy. Several strategies can reduce to prevent or mitigate negative bear human interactions. First, the use of electric fences can eliminate concentrations of bears around landfills. Programs to keep household garbage and recreational trash outside of the reach of bears have also been successful in some parts of Alaska.

Dredging and Filling: Dredging and filling operations affect coastal resources by:

- physical destruction of intertidal, wetland, upland, or benthic habitat and effects to the organisms that depend on these habitats.
- temporary increase in turbidity and a decrease in oxygen levels in water,
- suspension of toxic materials, heavy metals and other substances bound in sediments.
- modification of natural water circulation patterns
- Direct mortality of organisms swept into the dredge.

The impact of dredging operations depend on factors such as the method of dredging, composition of dredged material, the location and timing of operations, and the method of disposal of dredged materials.

Shoreline Modifications: Modifications to shorelines include bulkheads, riprap, breakwaters, causeways, piers, docks, and bridges. Unless designed properly, shoreline modifications can reduce the amount of habitat available, disrupt sediment transport, induce erosion or accretion, affect tidal circulation, and alter fish migration patterns. Structures that extend into marine waters can disrupt natural circulation and tidal flushing patterns.

Certain measures can reduce effects. For example, floating facilities and buildings on pilings generally have less impact on circulation, sediment transport and nearshore migration of fish. In some cases, breaches in causeways can reduce effects to circulation patterns and fish migration.

Water Withdrawal: Fresh water bodies throughout the AEB provide important habitat for fish. Withdrawal of water can affect fish by reducing areas available for overwintering as wells as reducing inter-gravel water needed for proper development of salmon eggs. Salmon are sensitive to fluctuating water levels and low water can destroy incubation of eggs and alevins.

Sedimentation: Sedimentation includes the deposition of fine organic and nonorganic materials on the bed of a stream, lake, wetland, or marine waters. While siltation is the suspension of fine particles in the water column, sedimentation relates to the deposition of fine particles. Sedimentation can occur from erosion, from flattening the stream gradient, from other alterations that result in decreased stream velocity, from gravel operations, dredging, fill, and surface runoff.

Sedimentation can adversely affect coastal resources by smothering fish food such as algae and invertebrates, smother incubating salmon eggs and young fry, and altering vegetation growth. Other effects of erosion are addressed under the natural hazards section.

Siltation: Siltation, also called turbidity, is the addition of suspended solids to freshwater or saltwater. Long-term turbidity can adversely affect plant and animal life by reducing light and thereby affecting photosynthesis and the ability to sustain fish. Salmon may avoid spawning in turbid waters (Bission and Bilby 1982; Lewbel 1983). Turbidity can also result in increased water temperatures because suspended particles absorb more radiation from the sun than clear water. Turbidity can also affect the amount of dissolved oxygen in the water and the ability to sustain fish.

Stream Channel Alteration: Streams may be altered by channelization (straightening or shortening channels), diverting watercourses, widening or narrowing, changing stream gradients, and removing vegetation. Alterations to streams can result in changing water velocity. The natural meanders in a stream absorb energy and add to the creation of pools and riffles that are important for fish.

Alterations to streams can result to changes to habitat including:

- a reduction in desirable habitat (such as overhanging banks, logs, and overwintering areas)
- changes in distribution of streambed materials,
- changes to temperature and dissolved oxygen levels,
- blockages to fish migration,
- erosion, and
- changes to stream velocity, depth and gradient.

Projects that alter the spawning substrate can affect salmon because there is some indication that eggs size of certain populations of salmon match the size of the gravel substrate in particular areas of watercourses.

Low dissolved oxygen, especially at hatching time, high or low stream discharges, low temperatures, disturbance, and predation can significantly reduce survival through the migrating fry stage.

Blockage of Fish Movement: Blockage of fish movements can occur from physical obstructions, water velocity, thermal barriers, or pollution. Inadequate or improperly installed culverts and other drainage structures can impede movements of fish, especially juvenile fish. Culverts that are too small create a velocity barrier to fish passage. Bridges are generally preferred to culverts as long as bridge supports do not lead to increased velocity or accumulate debris.

Material Sites and Mining: Mining can have significant effects on coastal resources and uses. Gravel mining and placer mining can result in increased siltation that in turn adversely affects fish habitat including spawning areas. Untreated disposal of mining wastes can pollute ground water. In addition, mining operations can alter habitat. Instream mining can alter river flow and lead to erosion of stream banks.

Settlement: Development of previously vacant land or disposal of public land through sales or leases for settlement purposes can have adverse effects. New settlements can lead to conflicts with recreation or subsistence uses including increased competition for fish and wildlife resources. Use of land for settlement purposes will have some degree of habitat alteration and noise from activities can displace wildlife. Generally, concentrated areas for settlements will have less of an effect on resources than multiple individual lots dispersed over a large area. Another issues with settlement involves a greater potential for bear-human encounters.

Predation: Development activities can upset a natural predator-prey relationship. A number of examples of increased predation in Alaska result directly from human activities. For example, there is some evidence that the oil and gas infrastructure on the North Slope has resulted in increased predation of bird populations from an increase in predators that are attracted to areas habituated by humans (NSF 2003). As reported at the 2005 Information Transfer Meeting for the Alaska Region of the Minerals Management Service, a study in progress has found that ravens near oil field infrastructure have a 90 percent success rate in producing fledglings, a much higher rate than in other areas of the region. Other examples of increased predation resulting from human activities include introduction of species, such as foxes and Norway rats, and an increase in predation of birds by gulls. In some areas of Alaska, the gulls have increased as a result of disposal of seafood processing wastes and discarding of bycatch (State of Alaska 2002).

Floating Facilities: Floating facilities can result in effects to coastal uses and resources. First, grounding of facilities in certain kinds of tidelands can damage habitat. Floating facilities, such as docks, can inhibit public access. Also, disposal of human wastes and gray water can be an issue for floating facilities without adequate containment and disposal systems.

Causeways: The construction of causeways results in temporary increased siltation and permanent covering of benthic habitat. Additional effects of causeways include disruption of water circulation patterns and fish migration.

Gravel Islands: Gravel islands for drilling oil and gas can have localized effects including increased siltation during construction and habitat alteration in the site of the island. Past practices of using sand bags in plastic bags has been stopped because the bags washed up on shore after the island degraded. Migrating birds can strike facilities on islands.

ORV Use: Off-road vehicle use associated with development can adversely affect wildlife and habitat. Noise from the activities can displace wildlife, and use of vehicles in certain areas can result in damage to soils.

Recreation Use: As described in more detail under the section on recreation, recreation activities can affect coastal resources and uses, especially subsistence hunting and fishing. As well, intense use of areas can damage habitat, displace wildlife and lead to adverse bear-human encounters.

Introduced Species: Throughout the years, many species have been introduced to the AEB ans surrounding areas both intentionally and unintentionally. While some introduced species have provided additional food sources or opportunities for income, they often compete with other biological resources. For example, the introduction of foxes for trapping and fur farming has resulted in an upset to the ecological balances. Certain plant species are invasive and compete with native species. As well, introduced animal species can compete with native fish and wildlife. Of special concern is the potential for non-indigenous farmed salmon to escape to rivers and streams. Wild cattle, located on Senak Island, were originally introduced by Russians and re-introduced during later years. Bison introduced in 1930s to Popov Island, provide a tourist attraction and a source of food.

Blasting: Blasting can have adverse effects relating to noise disturbance and damage to animals through the shock wave. Underwater explosions can rupture swim bladders in fish. Pressure tests with live fish indicated a peak pressure of 40 to 50 pounds per square inch is usually fatal to fish with swim bladders (Hubbs and Rechnitzer 1952). Incubating salmon eggs are extremely sensitive to shock.

Noise and Other Disruptions: The effects of noise depend on the decibel level, amplitude, frequency and whether it is pulsed or non pulsed. Development activities in flat terrain or areas without physical barriers may be more disturbing than when activities are obscured by vegetation or topography. Loss of habitat due to noise can affect reproductive success.

Nesting waterfowl and seabirds are particularly vulnerable to startling noises. Egg mortality may result from abandonment of nests or increased susceptibility to predation. Exposed eggs can become overheated or chilled. Molting birds are more susceptible to disturbance because they are under considerable physiological stress during the flightless period.

The physical presence of equipment, machinery, vessels, vehicles and human beings can alter the behavior of wildlife. The species most sensitive to disturbance in the AEB include ducks, geese, shorebirds, seabirds, harbor seals, and sea lions. Johnson et al (1989) has compiled a synthesis of information on the effects of disturbance and noise on sea lions and harbor seals.

Terrestrial Habitat Alteration: Project activities can affect terrestrial habitats by altering their productivity, changing vegetation composition or converting the habitat to other uses. Activities of concern include clearing, excavation, development of material sites, waste disposal, dredge spoil, fill areas for roads or other facilities, development of port and harbor facilities, and residential and commercial developments. The loss or alteration of habitats is most critical for wildlife populations in areas important for feeding or seasonal use.

Water Pollution: The waters of the AEB are vulnerable to pollution from oil and petroleum products. Sources of such pollution include chronic discharges or one-time spills. Marine vessel fuel, lubricants and refined petroleum products are transported through the AEB.

The toxicity of oil to individual fish and shellfish species is well document in laboratory studies, but extensive fish kills after oils spills have not been observed. Sub-lethal effects are poorly understood. It is not known if fish can detect and avoid spills. There is some evidence that oil spills in anadromous fish streams can interfere with the homing ability of salmon (Maynard and

Weber 1981; Thorsteinson 1984). Sub-lethal effects of oil on fish and shellfish may include changes in organ tissues and physiology, increase vulnerability to disease, decreased growth, and interference with the reproductive process (Rice 1981; Lewbel 1983).

Birds are particularly vulnerable to oil spills. When coated with oil, bird feathers lose their insulating qualities and the birds may die of exposure or drown. If oiled birds attempt to clean their feathers, they may ingest oil and die from its toxic effects. When bird eggs are contaminated with oil, their hatchability is reduced, and hatched birds have a large proportion of deformities which ultimately lead to death. Seabird nesting sites, resting locations, and pelagic feeding areas are all extremely sensitive to oil pollution, as are waterfowl feeding, nesting, molting, and staging areas (Thorsteinson 1984; Staff et al. 1981).

Fish Processing Wastes: Disposal of fish processing wastes by floating and onshore processors in waters can have serious consequences to marine habitats. Historically, up to 60% of wastes were discharged in to the marine environment, but improvements have reduced discharges. These measures include recovery of fish oil, installation of fish meal plants, and use of smaller mesh screens for discharges.

Three primary effects result from the discharge of fish processing wastes include an increase in total suspended solids (TSS), an increase in biological oxygen demand (BOD) that reduces available oxygen, and an increase in oil and grease. The degree of impacts relate to the amount of waste that is discharged, the type of seafood being processed, the degree of natural flushing at the discharge location, and the type of habitat at the discharge site.

In addition to the effects discussed above, disposal of fish processing wastes can lead to an increase in predators, such as gulls, that also feed on young of other bird species and compete with them for habitat (State of Alaska 2002).

Marine Debris: Marine debris affects coastal resources by increasing mortality or damage to fish and wildlife that become entangled with the debris. This debris often originates from floating vessels. A lack of law enforcement, resistance to degradation by some materials, limited landfill space in Alaska, and a lack of ease for proper disposal of materials all contribute to this problem.

Aquatic Farming: Aquatic farming has the potential to conflict with fish and wildlife and their habitat. While finfish mariculture is not allowed in Alaska waters, it occurs in the waters of British Columbia, and at the time this plan was written, there was a proposal to allow mariculture in federal waters. Depending on the type of mariculture, the following effects may occur.

- Exclusion of other uses in areas used for mariculture.
- Noise from movement of pens.
- Accumulation of fecal wastes under pens.
- Escape of non-indigenous fish to nearby streams.
- Competition between hatchery fish and native fish.

Oil and Gas: Oil and gas exploration and development can significantly affect coastal resources and uses. The most important effect would be from an oil spill, especially an offshore spill. Other effects include displacement of wildlife, recreation, subsistence, and commercial fishing activities. Seismic exploration activities can displace fish and marine mammals and interfere with commercial fishing operations. Other effects resulting from facility construction would be similar to other developments. Pipelines have the potential to disrupt wildlife migration, especially when

associated with roads. Subsea pipelines can interfere with fishing operations, especially when the pipelines are not buried.

Transportation and Utilities: Construction of transportation and utility facilities can have significant effects to coastal uses and resources. Roads result in physical changes to the habitat itself by displacing animals and disrupting migration paths. An effort in Louisiana to link wildlife migration corridors focused on providing access under roads where the natural corridors had been cut off.

Roads produce noise which can affect some animals. Roads also change drainage patterns and improperly placed culverts can be a barrier to fish migration, especially young coho salmon that use small tributaries for rearing. Erosion and runoff can result during road construction leading to increased suspended solids in water bodies. In addition, roads provide access for hunters and fishermen to areas previously not easily accessible. This access can lead to new pressures on fish and wildlife populations.

Other utility facilities also affect coastal resource and uses. Hydroelectric projects can affect coastal resources by altering stream flows and blocking fish passage. Impounded water bodies will change the habitat. Utility corridors for pipelines and transmission lines can disrupt wildlife migration. Facility construction can damage or destroy unmarked graves, archaeological sites and historic sites.

6.6.3.4 Relationship between Freshwater and Saltwater Systems

The purpose of this section is to establish the connection between upland environments and marine waters. New ACMP regulations adopted in 2004 require the establishment of important habitat areas in order for coastal districts to establish enforceable policies. Important habitat areas established by a coastal district must demonstrate that the use of those habitats has a direct and significant impact to marine waters (11 AAC 114.250(h)).

There is a close connection between land and water systems in Alaska. Activities occurring far from the ocean can have a direct and significant impact on marine waters. The amount of freshwater and its chemical composition directly affect saltwater areas, especially estuaries and nearshore areas. Any activity in a watershed that affects the quantity of freshwater or its chemical composition will have an effect on the marine waters.

Nutrients that enter marine waters from freshwater come from a variety of sources including detritus from waterbodies far from the ocean. The slow decomposition of pacific salmon provide an influx of nutrients, and some of these nutrients are exported to marine waters. Wipfli et al. (2002) found that invertebrates and detritus from forested headwater streams were exported downstream year-round. The connectivity between these habitats is an important ecological factor.

The greater the number of salmon that return to a stream, the greater the nutrient load of the river. Nutrients are spread to the land through ingestion by carnivores. These nutrients eventually leach through the soil and return to the stream either directly or through the decomposition of streamside vegetation (Wipfli et al. 1999, Wipfli 1997). Carcasses of dead salmon and other animals that prey on salmon act as a “slow-release” fertilizer that provides nutrients to the freshwater throughout the year (Wipfli 1998).

Freshwater inflow to estuaries provides a critical factor for the productivity of the ecosystem. The inflow of freshwater to determines what species can be supported in an estuary. The influx of river water creates an estuarine circulation pattern – the less dense riverine water override denser marine waters resulting in a mixing of the bottom layer of water. Estuaries are important because they provide important breeding and nursery habitat. The amount of freshwater, the amount of sediments and the amount of nutrients in the water are all important factors. Estuaries are important to survival of salmon (Emmett and Schiewe 1997). For example, the interface between the freshwater and saltwater is considered a critical habitat in the Columbia River system (Casillas 1999).

The mechanisms by which the Columbia River estuary and plume affect juvenile salmon survival have not been quantified, but likely include provision of food, refuge during transport away from coastal predation, and improvement of estuarine conditions for subyearling fish. Since the Columbia River estuary and plume have been significantly altered from historical conditions and hatchery stocks may be affected differently than natural stocks, the system's altered state likely contributes to the overall reduction of salmon. The impact of hydrosystem effects on reducing spring river flow and suspended particulate matter transport on salmon production in the estuarine and coastal plume environment may be large, as flows in most years may now be sub-optimal for salmon production.

6.7 Commercial Fishing and Seafood Processing

Commercial fishing and seafood processing represent the most important sector for the economy of the AEB. This section begins with a description of areas designated as suitable for commercial fishing facilities followed by an update to the resource inventories and resource analyses.

6.7.1 Areas Designated as Suitable for Commercial Fishing

The AEB designates all marine waters within its boundaries as suitable for commercial fishing under 11 AAC 114.250(f). Chapter 7 provides more information on this designation. Although federal lands are not included in this designation, a project requiring a federal consistency determination or federal consistency certification "within or affecting land or water uses or natural resources of the coastal zone is subject to state standards in 11 AAC 112.200 – 11 AAC 112.990 and to applicable enforceable policies of a district coastal management plan approved under 11 AAC 114" (11 AAC 110.015).

6.7.1 Commercial Fishing and Seafood Processing Resource Inventory

This section supplements the 1984 resource inventory and the 1992 revision to the inventory. It includes a summary of fish and shellfish resources important for commercial fishers. Seafood processing of these species is an important component of the AEB economy. Commercial fishing is important for every AEB community except Cold Bay. Seafood processing plants are located in Sand Point, King Cove, False Pass and Akutan. Additional information about the commercial fisheries is provided under the resource analysis supplement.

6.7.2.1 Fish and Shellfish

Commercial catches of the area's abundant fisheries resources are regulated under a complex

management scheme that involves both federal and state agencies. Harvesting and processing is divided among shore-based and at-sea processors. Shore-based processors report activity to the ADFG. A substantial portion of the Bering Sea/Aleutian Islands and Gulf of Alaska offshore fisheries catch is allocated to at-sea processors, who transport their products directly to market (SWAMC 2003).

6.7.2.2 Salmon

Salmon fishing is important to many AEB residents, and all 5 species of Pacific salmon occur in the region. After hatching in freshwater systems, the fry rear for a varying period of time in freshwater, depending on species, and then migrate to the marine environment. Salmon range widely across the North Pacific Ocean and the Bering Sea. Pink salmon are the most numerous of salmon species in the Alaska commercial catch and the most abundant salmon in the Pacific Ocean. Sockeye are the second most numerous in the commercial catch and third most numerous species. The Bristol Bay sockeye run is one of the most important commercial fisheries and part of the catch is harvested as the returning adult salmon migrate past the Alaska Peninsula in June (Kruse et al. 2000).

Coho salmon and chinook salmon are less well represented in the commercial catch, but are of great importance to personal use and sport fisheries. Many coho salmon runs are not commercially exploited due to run timing and weather conditions during their runs, the last of the salmon to spawn. Chinook are highly prized due to their large size (Kruse et al. 2000).

6.7.2.3 Pacific Herring

Herring are located in distinctly different environments during different periods of the year. After spawning, most adults leave inshore waters and move offshore to feed. Presently, herring are harvested primarily for sac roe for sale to foreign markets. Herring are also commercially harvested for use as bait for the halibut, groundfish, crab, and salmon troll fisheries. The herring catch along the Alaska Peninsula is low and sporadic, according to ADFG. The last significant sac roe harvest occurred out of Port Moller in 1996 (Kruse et al. 2000). Harvest statistics for 1997 – 2004 show that no commercial herring harvest has occurred in the AEB, for bait, sac roe, or roe-on-kelp, during that period (ADFG/CFD 2005).

6.7.2.4 Pacific Halibut

Pacific halibut are regulated separately from other bottom-dwelling fish. Most young halibut ultimately spend from 5 to 7 years in rich, shallow nursery grounds such as in the Bering Sea. Younger halibut, up to 10 years of age, are highly migratory and generally migrate in a clockwise direction east and south throughout the Gulf of Alaska. Halibut in the older age classes tend to be much less migratory. The International Pacific Halibut Commission oversees research and management of the stocks of Pacific halibut under terms of an international convention between Canada. Six commissioners, three from each country, make up the commission.

6.7.2.5 Groundfish

Walleye Pollock: This species is distributed throughout the Aleutian Islands with concentrations in areas and depths dependent on season. Larger pollock tend to be found in spawning areas from February to April. There is not a distinct Aleutian Islands (AI) regional stock of walleye pollock; the Aleutians populations appear to be continuous with catches further to the east. Targeted

fishing for walleye pollock in the Aleutian Islands region has been closed since 1999 due to concerns for Steller sea lions (Barbeau et al. 2004).

Pacific Cod: This species occurs at depths from shoreline to 500 meters, and are widely distributed in the Aleutian Islands. Since the fish have been found to travel throughout the Bering Sea-Aleutian Islands (BSAI) and Gulf of Alaska, no distinction is made among stocks. The Eastern Bering Sea (EBS) fishery accounted for and average of 83% of the catch for the period from 1999-2003 (Thompson and Dorn 2004).

Sablefish: The abundance of sablefish decreased in the 1970s due to heavy fishing but reached peaks in the late 1970s and in 1987, as a result of strong year-classes. The populations again decreased as the strong year classes have reached the end of their life cycle. Relative abundance in 2003 was 6% lower than in 2000. Adult sablefish occur along the continental slope, shelf gullies, and in deep fjords, generally at depths greater than 200 meters. They are considered a single population in federal waters off Alaska because they migrate throughout the region. They are caught in a hook and line IFQ fishery; some are also taken as bycatch during directed bottomfish trawl fisheries (Sigler et al. 2004).

Yellowfin Sole: This species is a benthic species that occur from British Columbia to the Chukchi Sea. Although they are the most abundant flatfish in the EBS, the population abundance in the AI region is negligible. They are the target of the largest flatfish fishery in the U.S. (Wilderbuer and Nichol 2004).

Greenland Turbot: Within the territorial waters of the U.S., this species is mainly distributed in the EBS and AI regions. Juveniles are not found in the AI region and it is suspected that the population comes from the EBS or elsewhere. The species is capable of movement over large areas. Prior to 1985, Greenland turbot and arrowtooth flounder were managed together, but they are now given different market quotas because they have large differences in market value. In 2004, the population in the AI was estimated to be 15% higher than in 2002 (Ianelli et al. 2004).

Arrowtooth Flounder: This species is a large flatfish that stays in continental shelf waters until the age of 4, and thereafter it can be found in both continental shelf and continental slope waters. The species is far less abundant in the AI and in the EBS, but are managed as a single stock. They were managed with Greenland turbot until 1986 since they were not a targeted species and were caught mainly as bycatch in the Greenland turbot fishery. They have a low commercial value, and most that are caught are discarded (Wilderbuer and Sample 2004).

Rock Sole: This species is distributed mainly in the continental shelf in the EBS, and in lesser amounts in the AI region. Northern rock sole are found in the BSAI, but there is species overlap with a related southern rock sole in the Gulf of Alaska. In the BSAI they are managed as a single stock. Rock sole are important as the target of a high value roe fishery during February and March, which accounts for the majority of the annual catch (Wildebuer and Walters 2004).

Flathead Sole: These fish are distributed from northern California along the West Coast and throughout Alaska. They are commonly confused with a related and similar species, the Bering flounder, a species that ranges into the Chukchi Sea and western Bering Sea. Substantial amounts of flathead sole are discarded when taken as bycatch during targeted fisheries in the EBS. Several other species of flatfish also occur in the BSAI (Spencer et al. 2004).

Pacific Ocean Perch: This species inhabits the Outer Continental Shelf (OCS) and upper slope regions of the North Pacific Ocean and Bering Sea. Until 1990, they were managed as a group

along with four associated rockfish species (northern, rougheye, shortraker, and sharpchin rockfish). In 1991, management of Pacific Ocean Perch was separated from other red rockfish to prevent overfishing. Since 2001, the BSAI fishery has been managed as a single species since it is uncertain whether EBS fish represent a discrete stock. The peak catch of this species in the AI occurred in 1961, after which the species declined and it is concluded that the stocks were not productive enough to sustain large removals. The decline continued into the 1980s, but after the establishment of the U.S. Exclusive Economic Zone (EEZ), the population in the AI showed increases until 1997, and has since fluctuated. (Spencer et al. 2004).

Northern Rockfish: This species was harvested by Japanese trawlers and U.S.-Korean joint ventures during the 1970s and 1980s. There is currently no targeted fishery for Northern rockfish in the BSAI; the species is taken as bycatch in the area. Prior to 1990, the catch was small as compared to recent years. Approximately 90% of the fish are harvested in the Atka mackerel fishery (Spencer et al. 2004).

Shortraker/Rougheye Rockfish: These fish were reported as "other species" during the 1980s. They are not caught in targeted fisheries, rather they are harvested incidentally during rockfish, Pacific cod and Atka mackerel fisheries in the Aleutian Islands. In the EBS, they are caught largely in the Pacific cod, sablefish, Greenalnd turbot and arrowtooth flounder fisheries. They are sometimes caught in excess of the amount that would likely be allowed in a targeted fishery. The allowed bycatch for this species is evenly divided between the BS and AI fisheries, since insufficient information about their stock structure has been collected (Spencer and Reuter 2004).

Atka Mackerel: Catches of this species increased during the 1970s, reaching a peak of over 24,000 metric tons (mt) in 1978, when they became a reported group in the BSAI Fishery Management Plan. Fished almost exclusively by foreign vessels during the 1970s, and later by U.S. joint ventures, since 1990, all Atka mackerel catches have been made by U.S. fishermen. The fishery is highly localized and managed and usually occurs within the same few locations each year, at depths less than 200 meters. Beginning in 1992, the Total allowable catch increased steadily due to the existence of a large exploitable biomass (Lowe et al. 2004).

Squid and Other Species: Squid and other species, such as sculpins, skates, sharks and octopi, are considered by the NPFMC to be ecologically important and to have potential economic importance, although there is currently no targeted fishery for any in the category. In the BSAI, squid is considered separately from the "other species" group. Information on distribution, stock structure, and life history characteristics is limited for squid and other species in the area. Catch statistics are recorded only in the aggregate when these species are caught incidentally (Gaichas et al. 2004).

6.7.2.6 Shellfish

Red King Crab: This crab species declined in abundance through the decade of the 1960s and reached a low in 1970-1972. Abundance rose and declined, leading to closure of the Bristol Bay fishery in 1983. A limited fishery was opened each year between 1984 and 1993. After a closure in 1994-1995, a fishery was reestablished, with a total catch of 16.4 million pounds in 1998 (Witherell 1999) For 2004, a total of 19.04 million pounds of King crab (mostly Bristol bay red king) was harvested, for a total ex-vessel value of $82.35 million (ADFG/CF 2005)

Tanner Crab: There are four species of tanner (snow crab) in the region: *Chionoecetes bairdi* and *C. opiho*, which predominate, and *C. tanneri* and *C. angulutus*, which are fewer in number.

They are concentrated around the Pribilof Islands and in Bristol Bay, and are found in lower abundance in the Gulf of Alaska. The Tanner crab stock of the Aleutian Islands is very small and populations are found only in a few bays and inlets.

Snow Crab (*c. opiho*) harvests increased from under one million pounds in 1974 to over 315 million pounds in 1992, followed by four years of reduced harvests. The stocks rebounded quickly and the harvest increased to 196 million pounds in 1998 (Witherell 1999). In 2004, there was no Tanner crab fishery, and the harvest of snow crab was 23.94 million pounds, with an ex-vessel value of $48.6 million (ADFG 2005).

The NPFMC has developed a Crab Rationalization Program which allocates BSAI crab resources among harvesters, processors, and coastal communities. The program is a limited access system that attempts to balance the interests of several groups who depend on these fisheries. The Program is intended to address conservation and management issues associated with the current derby fishery, reduce bycatch and associated discard mortality, and increase the safety of crab fishermen by ending the race for fish (NPFMC website 2005).

6.7.3 Commercial Fishing and Seafood Processing Resource Analysis

This resource inventory supplements the 1984 inventory for the AEB CRSA and the 1992 revision. It begins with a discussion of why the resource is a unique concern to the AEB followed by a discussion of how commercial fishing and seafood processing is sensitive to development.

6.7.3.1 Unique Concern

Commercial fishing and seafood processing are a unique concern to the AEB because these industries play an essential role in the local economy as well as a contribution to the identity of the communities. For many residents, fishing is a way of life.

6.7.3.2 Sensitivity to Development

Commercial fishing and seafood processing are sensitive to development in a number of ways. Anything that interferes with the ability of commercial fishers to catch fish will affect them as well as seafood processors. Development activities that affect fish habitat, both onshore and in marine waters, will affect fish populations with a direct effect on fishers and seafood processors. Activities that could result in the tainting of fish, or the perception of tainting, will affect seafood markets and therefore affect both the commercial fishing and seafood processing markets. Additional discussion on these effects are included below as well as in section 6.6.3.

6.7.3.3 Analysis of Commercial Fishing

Federal fisheries are managed by the National Marine Fisheries Service (NMFS), which is within the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. Certain fisheries are also overseen by the North Pacific Fisheries Management Council (NPFMC) and the International Pacific Halibut Commission (IPHC). Generally, the federally managed fisheries are those occurring within the EEZ, from three to 200 miles offshore.

The ADFG has oversight for state fisheries, which generally occur within three miles of shore. Responsibilities for state fisheries are divided among the Board of Fish, the Division of Commercial Fisheries, the Division of Sport Fish, and the Division of Subsistence.

Salmon provide the basis for one of Alaska's oldest and most important industries and underpin a traditional subsistence lifestyle in Native villages. The 2004 total commercial harvest in the Alaska Peninsula, Aleutian Islands, and Atka-Amlia Islands Management Areas was 17.5 Chinook, 4.6 million sockeye, 270,000 coho, 6.7 million pink, and 806.9 thousand chum salmon. The harvests of Chinook, sockeye, and pink salmon were above the 10-year average for 1994-2003, and the number of permit holders participating in the fishery was well below average. The total ex-vessel value of the harvest ($15.3 million) was 64% of the 1994-2003 average value of approximately $24.1 million (Eggers 2005).

The salmon resources of Southwest Alaska were the economic mainstay of the region for many centuries. It was the basis for the beginning of a lasting cash economy in the region as early as the 1880s. However, the development of foreign farmed salmon began changing the dynamics of the world market for salmon in the late 1980s and early 1990s. By the mid- to late-1990s, a glut of farmed salmon from Chile, Canada and Scandinavia undercut the wild salmon market by providing a standardized product, with regular availability and lower prices than wild salmon (SWAMC 2003).

Episodic wild salmon run declines in the region prompted economic disaster declarations. Even as the salmon runs recover, the values of the product have declined, however. In 1994, the ex-vessel value for all salmon species was more than $269 million. This number declined by nearly 78% to less than $60 million for all species in 2002. Limited entry permits similarly declined in value. Direct disaster assistance has been made available to affected individuals, businesses and municipalities to offset fisheries losses and their impacts. Increased efforts are being made to market wild Alaska salmon (SWAMC 2003).

The domestic groundfish fishery off Alaska is an important segment of the U.S. fishing industry. Nearly all of the commercial groundfish catch off Alaska occurs in the BSAI and the Gulf of Alaska groundfish fisheries. The total catch in these areas in 2003 accounted for 51% of the weight and 18% of the ex-vessel value of total U.S. domestic landings (Hiatt et al. 2004).

Community Development Quota Program: The Western Alaska Community Development Quota (CDQ) program was developed in 1992 to extend the economic opportunities of productive fisheries in the BSAI area to small, rural communities. The CDQ program allocates a quota for these communities. The Aleutian Pribilof Island Community Development Association (APICDA) is the CDQ organization for the Aleutian Islands area, specifically the 3 communities within the AEB, Akutan, False Pass and Nelson Lagoon, and 3 communities outside the borouogh, Atka, Nikolski and St. George. The CDQs involve groundfish, crab and halibut fisheries under a quota system. The CDQ groups are required to manage their catch to stay within all of their CDQ allocations of harvestable species (DCED 2002).

Quotas are assigned under the program for halibut, four stocks of king crab, two stocks of tanner crab, sablefish, turbot, Pacific cod, pollock, Atka mackerel, yellowfin sole and other flatfish, rockfish, and Pacific Ocean perch. Prohibited species under the program include some halibut, salmon and crab stocks. Any catch of these stocks, and incidental catch of prohibited stocks, are counted in the CDQ's quotas (DCED 2002).

The fishery resources of the CDQ program are under federal jurisdiction, but the program is

implemented by the State of Alaska. Allocations are made based on a percentage of the estimated biomass of a species and in consultation with the North Pacific Fisheries Management Council (DCED 2002).

Annual CDQs or specific harvest quotas are determined each year NMFS establishes fishing limits for the fisheries of the BSAI. The harvest quotas include amounts of fish harvested as target species (those intended to be caught) and bycatch species (those taken as incidental harvest) in directed or target fishing operations. Some bycatch species have market value and are processed and sold, and others are discarded as waste or are prohibited from being retained (NSEDC 2005).

The commercial groundfish catch off Alaska totaled 2.2 million tons in 2003, compared to 2.1 million tons in 2002. The gross value of the 2003 catch after primary processing was approximately $1.5 billion. The groundfish fisheries accounted for the largest share (54%) of the ex-vessel value of all commercial fisheries off Alaska in 2003. The ex-vessel value of the groundfish catch before processing was $603 million, down from $608 million in 2002. The shellfish fishery was second with $175 million or 16% of the total Alaska ex-vessel value. The value of the Pacific salmon catch amounted to $168 million (15% of the total), and Pacific halibut contributed $167.8 million. The decline in ex-vessel value of the salmon catch in the last several years is the result of low prices paid to salmon fishers due largely to competition from farmed salmon (Hiatt et al. 2004).

The APICDA is assigned a total allowable catch (TAC) of groundfish and shellfish in the BSAI fisheries each year. APICDA owns one umbrella profit-making subsidiary, APICDA Joint Ventures, Inc, which has, in turn, invested in several subsidiary companies. The subsidiary corporations serve as the profit-making investment arms of the CDQ organization. The CDQ in 2005 has $30.7 million is assets, including nearly $6 million in long term reserves. APICDA's goals include the development of business opportunities and jobs, infrastructure, job training, and education. Since 1992, APICDA has constructed port facilities, modernized processing plants, purchased vessels and quota shares, acquired equipment, established a Longterm Reserve Account, and implemented training and educational programs. It has provided an average of 129 jobs per year to local residents, generating over $14 million in wages to residents of APICDA communities. Educational scholarships (330) totaling nearly $700,000 have been provided to CDQ residents, and 364 higher education scholarships worth $1.1 million have been granted to residents (APICDA 2006/08 CDP).

Individual Fishing Quota (IFQ) Program: The IFQ Program for sablefish and halibut longline fisheries off Alaska was implemented in 1995, after fourteen years of development. The program was a response to overcapitalization in the industry, which had seen a ten-fold growth in vessels over 50 feet in the nine years ending in 1988. The fixed gear fleet totaled about 1,000 vessels in 1992. Harvest seasons for halibut rapidly shortened and a call was raised for allocations in the fishery. As established, benefits of the IFQ Program included increased vessel safety, increased quality and supply of fish to the consumer, increased flexibility for scheduling, more opportunity to use resident labor for processing, increased ability to manage the harvest within limits, and improvement in allocation of the fisheries (Pautzke and Oliver 1997).

Participants in the IFQ Program were assigned quotas of the catch based on previous participation in the halibut and sablefish fisheries. Vessels, ownership limits, leasing and sales of shares, and other elements were regulated under the program. A quota share was also set aside for the community development program for disadvantaged western Alaska Native communities.

According to the General Accounting Office (GAO) "the Alaskan halibut IFQ program has had varied economic effects on processors. The program extended the halibut fishing season to 8 months, allowing more halibut to be processed and sold as a fresh product. This shift to fresh product led to the emergence of the buyer broker, an increased competition for fish, and higher halibut ex-vessel prices (prices paid to fishermen for raw product). In addition, a net decrease of 12 shore-based plants that processed halibut occurred between 1995, when the IFQ program was implemented, and 2001, as well as a reallocation of market share. For the 28 companies that processed halibut in both 1995 and 2001, 15 lost market share and 13 gained market share" (GAO 2004).

A report by the National Oceanic and Atmospheric Administration (NOAA) Restricted Access Management Program produced a scorecard for two AEB communities with residents participating in the IFQ Program. For King Cove, 21 persons participated in the halibut fishery in 1995, with total earnings of $213, 357. In 2004 there were 12 participants who earned $573,263, an increase of 169% in earnings, but a decrease by 43% in participation. Sand Point residents participating in the fishery in 1995 numbered 38, with total earnings of $310,701. Thirty-seven persons were permitted to fish in the IFQ fishery in 2004, essentially unchanged from 1995. However, fewer than four individuals actually participated; thus the earnings are kept confidential by the State (NMFS/RAMP 2005).

6.7.3.4 Competing Uses and Impacts

Many concerns about competing uses and impacts to commercial fishing impact the AEB fishing industry. Issued described in this section include endangered species, mixed-stock fisheries, bycatch, reduction of access, contamination, sociocultural effects resulting from loss of access to fisheries, and habitat damage. This section ends with a discussion of keystone species.

Endangered Species: The western stock of Stellar sea lions has been listed as endangered under the Endangered Species Act after experiencing a decline in population over several decades beginning in the 1960s. The greatest declines since the 1970s occurred in the eastern Aleutian Islands and western Gulf of Alaska, but also in the central GOA and central Aleutian Islands. Counts at selected sites indicated a 40% decrease in the remaining population from 1999 to 2000. The numbers indicate a total decline from approximately 109,880 animals in the late 1970s to approximately 18,325 in 2000 in the combined GOA and BSAI region (NMFS/OPR 2005)

Several theories have been advanced to explain the decline, including overfishing, environmental changes, disease, killer whale predation, or a combination of some or all of those factors. There is not agreement, however, on the exact cause of the decline. In 2000, the NMFS developed a Biological Opinion asserting that continuation of the groundfish fisheries under the Fishery Management Plan in effect at that time was likely to jeopardize the subject sea lion population. Complicated area-specific management measures were designed to reduce direct and indirect interactions between the groundfish fisheries and Steller sea lions, particularly in waters within ten miles of rookeries and haulouts (NMFS/OPR 2005). Restrictions on timing and location of fisheries have the potential to cause economic distress to individuals and communities dependent upon the fishing industry.

Mixed Stock Fisheries: Mixed-stock salmon fisheries present management problems because they include fish bound for rivers in different regions of Alaska. The False Pass mixed-stock sockeye salmon fishery that occurs in June along the south side of the Alaska Peninsula has presented problems for the management of the Area M fishery. Chum salmon fishermen in the

Yukon-Kuskokwim area believe their allocation of has been decreased due to bycatch of Chum salmon in the mixed-stock False Passe sockeye salmon fishery (Gray 1990)..

In response to weak chum salmon runs in the Kuskokwim River and Norton Sound in 1998, the Alaska Board of Fisheries instituted a suite of measures to address the issue of bycatch of fish headed to the Arctic-Yukon-Kuskowskim (A-Y-K) region. These measures implemented an abundance-based ceiling on the number of chum salmon that could be caught in the June commercial salmon fishery in South Unimak and Shumagin Islands. The earlier chum cap for the False Pass fishery was 700,000. The board voted to establish a variable chum salmon cap from 350,000 to 650,000 fish (BOF press release).

The False Pass commercial fishery is extremely important to the AEB fishers. The ADFG has classified the Kuskokwim River chum salmon, however, as a "stock of concern." In 2002 and 2003, abundance increased and provided sufficient opportunity for all Kuskokwim River subsistence fishers to harvest the amount needed for subsistence. A limited schedule for subsistence harvest has been imposed partly because of weak Chinook salmon runs in the AYK area, which are believed to be caused by environmental conditions in the ocean (Bergstrom and Whitmore 2004).

Bycatch: The incidental catch of nontargeted species is a significant problem. Some 300 million pounds of edible fish are caught and discarded overboard each year. Of the bycatch of out-of-season fish up to 90% are dead or mutilated (MSSP 1995). In addition to fish, seabirds are also incidentally caught, typically while diving for forage fish (Livingston 2001).

Chinook and chum salmon are caught incidentally in Alaskan groundfish fisheries. From 1990 to 2001, an average of 37,819 chinook salmon and 69,332 other salmon species were incidentally caught in the BSAI groundfish trawl fisheries (Witherell et al. 2002). On average, a single trawl net load of 100 mt of pollock, half of which are undersized for the processing equipment to manage, meant that 110,000 pounds of juvenile pollock were thrown back (MSSP 1995). Use of bottom trawl gear to fish for pollock was prohibited in 1999 (Witherell 2000).

Norton Sound bound summer chum salmon are caught as incidental bycatch in the Bering Sea groundfish fishery, and the allowance of this catch for subsistence may increase the overall subsistence chum harvest (Salomone and Bergstrom 2004).

Reduction of Access: Access to resources are necessary for successful harvest; restricted access may require use of alternative resources, crowd harvesting in remaining areas, and result in higher costs associated with their harvest. Restrictions that result in a loss of access can result from petroleum exploration activities, dredge and fill, and construction of port and harbor facilities. Certain resources may only be available for commercial harvest over a short period of time, and loss of access may severely reduce harvest levels.

Contamination: Real or perceived contamination of commercial fishery resources from petroleum product spills, waste discharges and mining activities can create public health concerns, and affect market and consumer confidence in fish and shellfish products. Loss of availability and confidence in resources can have associated social and economic effects on commercial fishermen.

Socioeconomic Impacts from Loss of Fishing: Any reduction in commercial fishing harvest can create economic and social impacts. Reduced income may jeopardize maintaining commercial fishing gear, and create economic hardship to individuals and communities through reduced cash

income. Social effects of reduced commercial fishing catch, such as those documented in the aftermath of the *Exxon Valdez* spill, can also impact families and communities.

Habitat Damage: The major cause of the loss and degradation of salmon populations elsewhere is the destruction of their habitat. When rivers are dammed, or re-channeled, when lakes are polluted or become eutrophic, when road construction erodes sediments into streams, or the riparian zone is paved over, then salmon inevitably disappear (Adkinson and Finney 2003). Many of the potential impacts to salmon and other fish habitat, such as dredging and filling, shoreline modification, blockage of fish passage, and water pollution are discussed in Section 6.6.3.

Fish are sensitive to disturbance from human activities, and may be extremely vulnerable in certain areas or during certain times of year (spawning, rearing, and migration). Damage to spawning and rearing habitat, and blockage of fish migration in anadromous fish streams are of particular concern. Other species, such as shellfish, may not be able to leave an area of disturbance.

Keystone Species: Some species are bellweather species that signal the relative health of an ecosystem. Some are also critical to the health of an ecosystem that relies on their function. Walleye pollock is such a species. Juvenile walleye pollock prey upon zooplankton (which are also the primary foods for Pacific ocean perch and Pacific herring). In the eastern Bering Sea, adult pollock have been found to prey primarily upon small pollock, as do large-mouthed species such as arrowtooth flounder, Greenland turbot, and Pacific halibut. Many other species, such as sculpins and skates, prey upon pollock. Juvenile pollock occupy a key position in the Bering Sea ecosystem by transmitting energy from zooplankton to larger fishes (Mito et al. 1999).

Pollock are also consumed by sea lions and some seabirds, and may constitute a critical element of these forager's diets. The pollock fishery in the Bering Sea, which accounts for 75% of all shore-based processing, had an allowable catch of 1.3 million fish in 2003 (Witherell 2000). Most of the 1.5 million tons of pollock harvested in the Bering Sea is processed into surimi, fish sandwich patties, and fish sticks. The fishery comprises approximately one-third of all U.S. seafood landings at an estimated ex-vessel value of $750 million in 2003 (SWAMC 2003). Thus pollock are a keystone species for both the humans and nonhumans in the Bristol Bay ecosystem.

Human competition for pollock impacts the number available for other users. Biologists are also studying whether disturbances from fishing operations themselves may affect the availability of pollock as prey for non-human foragers. Disturbed fish may move deeper into the water column to form smaller, denser aggregations, which may adversely affect the foraging behavior of Steller sea lions. This may also be true for other forage fish such as capelin, a fattier fish important to seabirds (Wilson et al. 2003).

Human effects on a fishery can in turn affect human use of a fishery. The pollock fishery has been affected by management measures designed to protect Steller sea lions. In 1990, roe-stripping of pollock was prohibited, and the Bering Sea pollock fishery was divided into roe and non-roe fishing seasons. Changes have been made in the management of pollock fisheries that benefit Steller sea lions but restrict human fishing access to the fishery (Witherell 2000).

Invasive Species: The escape of farmed Atlantic salmon from British Columbian fish farms is of great concern because of potential competition for food, the potential to spread diseases or parasites, and impacts to habitat. Sea lice can be transmitted from farmed fish to wild fish. The potential exists for a foreign species to act as a vector for contaminants in freshwater ecosystems important to anadromous fish. Adkinson and Finney reference this possibility in a paper on the

future of Alaskan salmon runs. Levels of organic pollutants that were higher in a sockeye salmon nursery lake than in a nearby lake that salmon could not access suggest that the contaminants were transported by returning adult salmon (Adkinson and Finney 2003).

6.8 Energy Facilities

This section provides an update to the resource inventory and resource analysis included in the 1985 plan and 1992 supplement. The AEB has not chosen to designate any areas as important for energy resource development under 11 AAC 114.250.

6.8.1 Energy Facilities Resource Inventory

This section supplements the discussion in the 1984 resource inventory and the 1992 amendment to the coastal management plan. It includes a discussion on hydroelectric resources, wind resources and oil and gas.

6.8.1.1 Hydroelectric Resources

Two AEB communities currently generate power by hydroelectric facilities. King Cove's 850 kilowatt run-of-river hydroelectric facility on Delta Creek went online in December, 1994. The system provides approximately 24% of the community's power, and it was constructed with the assistance of the Alaska Energy Authority, the U.S. Department of Energy and the AEB (DCCED/AEIS 2005).

A 195-kilowatt facility was constructed in Akutan in 1991. It provides only about one percent of Akutan's power needs, but additional sources of hydropower for the community have been identified. Due to the hydropower component of the King Cove and Akutan power supplies, these two communities have the lowest unsubsidized cost of residential power in the borough (DCCED/AEIS 2005, Locher Interests Ltd. 1997).

A potential hydropower site in Ivanoff Bay that would provide electricity to Sand Point has passed preliminary screenings for project viability (Locher Interests Ltd. 1997).

6.8.1.2 Wind generation

The Aleutian Islands have the greatest wind energy potential in Alaska. To the extent that the area of the AEB is suitable for wind generation, the same barriers to its development in the Aleutians chain apply to the AEB. The major barriers to developing viable wind energy projects in the region relates to high project costs, anticipated conflicts with migratory bird and endangered species habitat, the integration of large amounts of wind energy into small village energy systems, and, to a lesser extent, the selection and use of wind machines capable of withstanding gusty winds and salty marine environments (DCCED 2005). Successful wind generation projects in Alaska have been developed in Kotzebue and more recently in Wales.

6.8.1.3 Oil and Gas

The two oil and gas provinces in the AEB with potential for oil and gas resources include the Bristol Bay Tertiary and the Alaska Peninsula Mesozoic Provinces. Map C illustrates the areas with the highest potential for oil and gas (Appendix E). The highest potential for oil and gas is

located on state lands and tidelands along the north side of the Alaska Peninsula and in federal offshore waters in the North Aleutian Basin (AECRSA 1984).

History of Oil and Gas Exploration: The first recorded discovery of oil resources in the area was made by the Russians near Kanatak in 1853. In 1902, a well was drilled near Puale Bay on the Alaska Peninsula, and by 1985, 26 test wells were drilled on the Alaska Peninsula. Seven of these wells were drilled in the AEB between 1961 and 1977 near Canoe Bay, Sandy River, David River, Hoodoo Lake, and the Cathedral River. Although oil and gas shows were discovered, no commercial quantities were found. Table 6-9 provides more information about the wells drilled in the AEB.

Table 6-9: Wells Drilled in the AEB

No.	Date	Well Name	Operator	Depth (feet)
1	1961	Canoe Bay	Pure Oil	6,642
2	1963	Sandy River 1	Gulf Oil	13,068
3	1969	David River 1-A	Pan American	13,769
4	1970	Hoodoo USA1	Pan American	8,049
5	1970	Hoodoo USA2	Pan American	11,243
6	1974	Cathedral River	Amoco	14,301
7	1977	Big River A-01	Phillips	11,370
1	1983	N. Aleutian Shelf #1	Arco	17,155

Source: Department of Natural Resources

The quality of data collected for these wells is considered poor by modern standards. Eighty-three electric well logs and 250 electric log scans were obtained for the Alaska Peninsula. Additional data collection will be necessary using current technology. The most recent seismic surveys were completed in the 1980's, before use of more accurate three-dimensional survey techniques. Use of new, state-of-the-art drilling methods will further define the oil and gas potential in the area, and new flow tests will provide a better understanding of the commercial potential of the area.

The DNR compiled a detailed summary of technical information for the proposed Alaska Peninsula Areawide Lease Sale. The agency assembled geologic, geophysical and other exploration well data on a three-volume CD set and on four large maps (DNR 2004). The CD data set includes: general information, digital well data, scanned electric well logs, and seismic data. Four large wall-sized maps provide information on oil and gas exploration well data and history, regional geology, oil and gas data, and seismic data.

Promising oil shows were observed in good quality sandstone reservoirs above 8,000 feet of depth in three wells drilled near Port Moller (Hoodoo USA1, David River 1-A, and Sandy River 1). Although some oil shows were evident below 8,000 feet, the reservoir rock quality is poor and may not produce oil in commercial quantities.

Oil and Gas Potential: According to the DNR, the area between Cold Bay and Becharof Lake is expected to be moderate to locally high for gas, and low to moderate for oil (DNR 2005). The DNR estimates there may be as much as 300 million barrels of oil in the 5-million acres of Alaska Peninsula and Bristol Bay Basin open to leasing. While there is some potential for gas in the AEB area, the gas potential is considered more promising in the Becharof Lake Area located northeast of the AEB. Significant gas was found in the 1985 Amoco Becharof #1 well. More work is necessary to develop a gas reserve estimate for the Alaska Peninsula and Bristol Bay Basin area,

however, the state is hopeful that reserves may be on the order of "multiple trillions of standard cubic feet," especially in the Becharof area.

During 2003 and 2004 the DNR conducted geologic surveys to improve the geologic database for the proposed Alaska Peninsula Areawide Lease Sale. As a result of the recent fieldwork and analysis of previous geologic surveys and exploration well data, DNR considers the Alaska Peninsula to be a promising area for oil and gas potential. Oil and gas seeps have been documented along the southeastern flank of the peninsula. An analysis of the geology, however, leads to the conclusion that reservoir quality could be poor, especially for reservoirs below 8,000 feet. Sandstone reservoirs at this depth may be plugged with clays and cements originating from eroded volcanic and plutonic rocks.

State Alaska Peninsula Lease Sale: The State of Alaska's 5-year oil and gas leasing program for 2004-2008 includes a new proposed lease sale for the Alaska Peninsula area. Under the proposal, one lease sale will be held each year in this area beginning in 2005. The proposed sale area covers a large area along the northern side of the AEB.

Although the State of Alaska previously issued oil and gas leases on the Alaska Peninsula, there are no current active leases. Lease sale measures would prohibit offshore drilling, but wells may be directionally drilled from onshore locations to offshore subsurface locations.

Based on previous oil and gas exploration in the AEB area, it is likely that most of the oil and gas exploration in the AEB will occur in the Nelson Lagoon and Port Moller area.

Cold Bay is poised to serve as the transportation hub for oil and gas activities. The high-quality airstrip and dock facilities offer adequate facilities to transport oil and gas equipment and supplies, especially during the early years of oil and gas exploration drilling. Airports and docks may eventually be located closer to any areas that were developed for oil and gas. Oil and gas companies are unlikely to invest in major infrastructure, however, until a significant oil and gas find has been confirmed and a financial commitment has been made to develop the resource. While it is logical to assume that Cold Bay will serve as a transportation hub for a five-ten year exploration period, it could potentially remain an important transportation node beyond that date.

A significant oil or gas find may require construction of a marine terminal in the AEB. It is possible that a terminal would be located south of Nelson Lagoon on the Pacific Ocean side of the Alaska Peninsula in Pavlof Bay or Balboa Bay. A marine terminal would be unlikely on the north side of the Alaska Peninsula due to the engineering design challenges of constructing marine facilities on the unprotected shoreline of the Bering Sea, potential conflicts with the Bering Sea fisheries and potential impacts to endangered species located in the area.

Federal Outer Continental Shelf Leasing: There are no current active leases in the federal Outer Continental Shelf (OCS) near the AEB. Four OCS planning areas are adjacent to the borough, two to the north (St. Georges Basin and North Aleutian Basin) and two planning areas to the south (Aleutian Arc and Shumagin). Federal sales were held in 1983 in the St. Georges Basin Planning Area and in 1988 in the North Aleutian Basin Planning Area. Twelve wells were drilled in the St. Georges Basin and one stratigraphic well was drilled in the North Aleutian Basin (AEB 2005). No lease sales are planned for the OCS planning areas adjacent to the AEB in the current OCS 5-year plan. It is possible that leases could be scheduled in the next 5-year program for the planning areas other than the North Aleutian Basin, if there was support to do so.

In response to significant opposition to OCS oil and gas leases issued in 1988 for the North Aleutian Basin Planning Area, Congress passed legislation that "bought back" the leases from the oil company lease holders. A current moratorium that closes federal waters in this planning area to oil and gas leasing expires in 2011, but there is some interest in removing the moratorium earlier (AEB 2005).

6.8.2 Energy Facilities Resource Analysis

This supplement to the previous resource analyses begins with a description of why oil and gas development and energy facilities are a unique concern to the AEB. It continues with a short discussion of resources and uses that are sensitive to development, and it ends with a discussion of conflicts with energy development.

6.8.2.1 Unique Concern

Energy facilities are a unique concern to the district for at least three reasons. First, AEB communities depend on energy facilities to provide electricity and to heat their homes. Second, local production of energy facilities has the potential to lower energy costs. Third, energy development, especially large projects, has the potential to impact other coastal resources and uses.

6.8.2.3 Sensitivity to Development

Other coastal uses and resources can be sensitive to energy development. Hydroelectric projects can conflict with fish habitat, oil and gas can impact fish and wildlife habitat, and wind energy can impact migrating birds. Specific sensitive areas are described in more detail in section 6.6.3.

6.8.2.2 Energy Development Conflicts

This section includes a brief discussion about potential adverse impacts and conflicts from energy development. More detailed information about effects from energy development may be found in the 1984 resource analysis (pp. 5-9, 60-70, 89-98, and 101) and the 1992 amendment to the CMP (pp. A-7, A-17 and B-3. The discussion under Section 6.6.3.2 (Biological Resource) also relates to effects from energy development.

Over 30 years of experience of oil and gas exploration and development on the North Slope and in the Cook Inlet region have resulted in many technological improvements and practices that have reduced impacts of early oil and gas operations. These techniques include use of ice roads or exploration during times when the ground is froze, underground injection of wastes, reduced size and number of gravel pads due to directional and multilateral drilling techniques, roadless developments, horizontal directional drilling for pipelines under rivers, and higher pipelines.

Spills and Discharges: Oil and gas exploration and development has the potential to affect coastal resources and uses. Of the highest concern is damage from a possible oil spill. The 1989 *Exxon Valdez* oil spill demonstrated that damage to coastal resources can extend far from the location of a spill. A large oil spill and chronic oil spills affect other coastal uses and resources. As mentioned earlier, an offshore spill would have the greatest adverse effects, and a spill in broken ice could have devastating results. Oil spill trajectory models used to estimate the severity of an oil spill may not be accurate.

In addition to crude oil spills, other fluids can be discharged to the environment including diesel oil, diesel, crankcase oil, saline water, produced water (from oil and gas separation), and other chemicals. An oil spill in broken ice presents one of the greatest risks for environmental damage. Oil spill drills have repeatedly demonstrated that existing technology is not sufficient to adequately remove oil from certain broken ice conditions.

Habitat Effects: The most obvious effect of oil and gas development is the reduction in habitat due to oil filed infrastructure. As discussed in other areas of this analysis, the construction of roads and pads can affect hydrology, vegetation, and animal populations up to several kilometers from the development.

Noise: Noise from oil and gas activities have significant effects to wildlife migration and human activities. Diversion of whales from noise results in whalers having to travel further out in the ocean thereby increasing risks of boating accidents and spoilage of whale meat. In addition, disturbance of whales during the fall could make whales more sensitive to noise further on their migration path thereby affecting whalers in Barrow.

Noise also affects onshore subsistence activities and distribution and migration of caribou. Subsistence hunters report that caribou have adverse reactions to low-flying airplanes. As discussed in the section on caribou below, noise from roads can affect distribution of calving caribou and the migration patterns of other caribou. Section 6.6.3.3 provides additional information on the effects of noise on animal populations.

Seismic Surveys: Offshore seismic surveys use high pressure air guns. These noises can affect the migration of bowhead whales and may disturb other marine mammals. A recent innovation, 3-dimensional seismic testing, results in a need for greater density of offshore arrays and onshore trails. Although an early study found that whales were affected only up to 4 miles, more recent studies have verified local knowledge that whales are affected at much greater distances, some up to 12 miles from the seismic operations.

Onshore seismic surveys record how sound waves are reflected through the ground from surface "thumpers." Although conducted during the winter, local residents are concerned that seismic surveys may be affecting animals.

Commercial Fishing: Offshore oil and gas operations can affect commercial fishing operations through fishing restrictions around offshore facilities, through seismic surveys and as a result of a catastrophic oil spill.

Subsistence Impacts: Oil and gas activities can affect subsistence uses and resources. The effects on subsistence can include reduced access, displacement of animal populations. As explained in the section about caribou, oil field activities can affect migration of caribou. Offshore noise from drilling and seismic operations can deflect whale migrations. There is a current speculation of NSB residents that future subsistence use access may be restricted as a result of new security measures.

Aesthetic Effects: Energy development can adversely affect aesthetic values by transforming the landscape. Pipelines have a high-degree of reflectivity. Oil development can result in more aircraft and a reduction of areas for solitude.

Off Road Travel: Early exploration activities resulted in damage to tundra. Today, the use of specialized tundra vehicles and ice roads reduce the damage to the tundra. Some damage to tundra occurs, but the effects are far less than previous practices of off-road travel or construction of gravel roads for exploration activities.

Roads: Roads have the potential to affect animal populations and migration patterns. Dust from roads can lead to earlier melting or areas adjacent to roads known as thermokarst (Walker et al. 1987). They can also result in an increase in visitors and hunters. As discussed under the section on caribou, roads can affect migration of caribou and calving caribou.

Pipelines: Pipelines can affect caribou migration, especially when they are grouped together, raised, less than 5 feet, and closely situated to active roads. Some North Slope residents believe the highly reflective pipelines may be a deterrent to animals. Companies are reluctant to bury onshore pipelines due to potential damage to permafrost and the difficulty to inspect for corrosion and leaks.

Abandoned Infrastructure: Relics from early exploration activities still may be found across Alaska. The obligation to restore lands from oil and gas development is unclear. It is not likely that much of the infrastructure will be eventually removed, because companies are not required to remove structures until a unit has ceased production. To date, no units have ceased production, and bonds are inadequate cover costs of removing pads (GAO 2002; NSF 2003).

Predation: An increase of food from humans can lead to greater populations of predators in the oil fields including brown bears, arctic foxes, ravens, and glaucous gulls. These species prey on bird eggs, nestlings, and fledglings.

Causeways and Islands: As explained in section 6.6.3.2, causeways and islands can affect fish migration and lead to temporary sedimentation.

Air and Water Quality: Oil and gas activities can affect water quality from oil, seawater and produced water spills (discussed above), disposal of muds and cuttings from offshore oil and gas exploration, sedimentation, thermal discharges, and discharges from desalination and seawater treatment plants. Little research has been completed to quantify effects of air pollution from Alaska oil and gas operations.

Ice Hazards: Ice hazards can affect subsea pipelines, gravel drilling island, ice islands, and onshore facilities near the coast. Ice gouging, ice override and ice pile up can all affect oil facilities.

Water Withdrawal: Water withdrawal from fresh water lakes or marine areas can result in the entrainments of fish. As development moves west to deeper lakes, there is more of a potential for water withdrawal to affect overwintering fish.

Social Impacts: A number of social impacts can result from oil and gas development. The increase in standard of life may not be able to be sustained as oil field production declines. Stress about a possible spill has resulted in a cumulative effect (NSF 2003).

Caribou: Oil field development can disrupt caribou migration and lead to increased predation. According to a 1994 report to the Alaska Caribou Steering Committee on the effects of North Slope oil development on caribou, the most important effects are impediment of movement though oil fields and displacement from calving areas (Cronin et al.). The report addresses

findings from a number of studies, but it notes that the lack of predevelopment data makes it difficult to assess effects on the overall Central Arctic Herd (CAH). Caribou can habituate to oil field facilities, but they become accustomed to humans and vehicular traffic more slowly.

The reproductive success of CAH near oil filed between 1988 and 2001 lower than for undisturbed areas. The expansion of oil development westward may have more significant effects to caribou because the coastal plain narrower than elsewhere.

The degree of disturbance to caribou depends on a number of factors including the amount of traffic, the number of pipelines and the distance between the pipelines and roads. The report to the Caribou Steering Committee included the following observations:

- Single pipelines elevated greater than 5 feet located adjacent to roads with low- level traffic do not significantly impede migration; moderate to heavy traffic, however, does have an effect.
- Long sections of buried pipeline allow free passage, but short gravel ramps over pipelines are not necessary because caribou will pass under the pipeline.
- Groups of caribou larger than 100 individuals are more affected by pipelines and roads than smaller groups, especially in areas with heavy traffic.
- Roads and pipelines have a synergistic effect on impeding movement.
- Cows with new calves avoid roads with traffic of greater that 100 vehicles per day.
- Buried pipelines provide the least barriers to movement, but they are costly, disrupt wetlands (due to need for gravel fill), and can result in thermal degradation of permafrost.
- Activity and facilities can force caribou to other areas where there may be increased predation, especially for vulnerable calves.

The Caribou Steering Committee study reported a number of mitigation measures that will likely reduce the impacts of oil field facilities and activities.

- **Regulate Traffic:** Effects can be minimized by limiting foot traffic, encouraging constant vehicle speeds, limiting traffic to times when caribou are not moving through the field, and use of busses to transport personnel. For areas where there are large movements of caribou, it may be useful to limit traffic to convoys.
- **Monitoring:** A joint industry-government monitoring effort or a monitoring program by borough residents can improve compliance with restrictions.
- **Elevate Pipelines:** Elevation of pipelines to at least 5 feet has been effective in facilitating movement of caribou, although higher elevations are preferred by caribou. For some projects, such as the Alpine Development Project, pipelines were elevated to 7 feet to allow for snow drifts.
- **Separate Roads and Pipelines:** Roads and pipelines separated by at least 500 feet facilitates movement of caribou.
- **Buried Pipelines:** Burial of pipelines is more costly, but it could be justified where there are large crossings of caribou. Short gravel ramps may not be preferred by caribou if the adjacent pipeline is elevated high enough.
- **Calving Areas:** Effects can be minimized in calving areas by avoiding construction of facilities, limiting the number of roads, and use of convoys during calving periods.

Local Hire: The experience of oil development on the North Slope reveals that a small percentage of local residents work in the oil fields. This situation results from a number of factors. Many of the jobs require specialized skills that may not be available in the local employment pool. The work schedules require employees to be away from home during extended

periods, and they may not accommodate leave for subsistence activities. In addition, transportation services focus on bringing people from Anchorage and Fairbanks rather than to and from the local villages. A 1997 Legislative Audit found that lease requirements requiring reporting of resident hire can result in more local hire programs (Alaska Legislative Audit 1997).

Cumulative Impacts: Cumulative impacts of oil and gas activities are of concern because assessment of cumulative impacts requires long-term studies and evaluation of impacts form multiple stressors. Ecological systems that appear to be functioning can suddenly collapse from stressors once the system reaches a threshold.

6.9 Minerals

This section begins with a supplement to the resource inventory and continues with an update to the resource analysis. The original 1984 and 1992 resource inventories and analyses are adopted into this plan and attached in Appendix C and Appendix D respectively.

6.9.1 Minerals Resource Inventory

Several areas in the AEB are considered to have high mineral potential. According to the U.S. Geological Survey, there are more than 100 prospects and mineral occurrences in the area of Herendeen Bay, Port Moller, and the Shumagin Islands, which constitutes Region 19 in the Bristol Bay Area Plan. The mineral showings are classified as silver-gold, gold, copper, copper-molybdenum, and lead-zinc. Mineralization is mostly related to hydrothermal activity associated with volcanism and the emplacement of shallow intrusive rocks. The most significant prospects include the following.

- The Pyramid prospect, located north of Balboa Bay, is a porphyry copper deposit with reserves of 125 million tons. The Pyramid Porphyry Project lies along the southern margin of the Alaska Peninsula north of the Shumagin Islands. It was discovered in 1974 by the Aleut-Quintana-Duval Joint Venture, which drilled 19 shallow holes in late 1975 (5,563 feet total), identifying a resource of 125 million tons of copper mineralization grading 0.403% copper and 0.025% molybdenum in a near-surface zone consisting largely of chalcocite-enriched rock. This historic resource was completed prior to 2001 and NPI 43-101, and should therefore not be relied upon. Gold was not an exploration target in the initial exploration effort. More recent exploration by Battle Mountain Gold in the late 1980's identified associated gold values that have greatly improved the potential at Pyramid (Full Metal Minerals 2005)

  A letter of intent dated July 13, 2004 between the Full Metal Minerals and Alaska Earth Resources Inc. (AERI) granted the Company an option to acquire a 100% interest in the Port Moller Property. Through this agreement, Full Metal has an exclusive option with the Aleut Corporation, a native-owned Alaskan corporation, to explore native-owned lands in the Port Moller quadrangle encompassing the western Alaskan Peninsula, an eastern Aleutian Islands. Additionally, Shumagin Village Corporation, the owner of surface rights in certain areas of the Port Moller region, has granted permission to the company to complete exploration on corporation lands (Full Metal Minerals 2005)

- The Apollo-Sitka mines, on Unga Island, produced approximately 145,000 oz of gold averaging 0.29 oz per ton, between 1891 to 1904.

- The Shumagin prospect, an epithermal gold prospect similar to the Apollo-Sitka, has an estimated 540,000 tonnes grading 10.3g/tAu, 34.3g/tAg. It is located on Unga Island. The Shumagin deposit hosts an uncut vein hosted resource of about 280,000 tonnes averaging 0.80 oz/ton Au and 2.7 oz/ton Ag, for about 224,000 oz of gold.

- The Centennial prospect, one of the two most advanced gold projects in the Port Moller Quadrangle is located on Popov Island adjacent to Sand Point. In the 1980s, Battle Mountain Gold Corp. identified 6,000,000 tonnes averaging about 1.5 grams per ton gold in an intermediate sulphidation epithermal system; mineralization occurs as quartz stockworks with pyrite and rare visible gold located below a capping basalt; there is limited potential to expand this deposit (Full Metal Minerals 2005)

An additional 36 mineral occurrences in the AEB can be found in the Lower Alaska Peninsula, Unimak and Krenitzen Islands. The majority of these are epithermal precious metal occurrences of gold and silver. Additional polymetallic prospects and porphyry copper-type occurrences are known. The mineral occurrences in this area are distributed on the Krenitzen Islands and from False Pass to near Belkogski. The area is considered by the Alaska Department of Natural Resources to have high potential for discovery of precious metals (Bristol BayArea Plan 2004).

The Herendeen Bay coal field has nine recognizable seams of bituminous coal ranging from 1.5 to 6.4 feet thick, more than half of which is clean coal (SWAMC 2003). Together with the nearby hignik coal field, identified Cretaceous bituminous and subbituminous coals ranging up to 3 billion short tons (DNR 2004). Lignite occurs in the region in seams less than eight feet thick and are extensive on the Alaska Peninsula (SWAMC 2003).

6.9.2 Minerals Resource Analysis

Geographic distances, limited transportation infrastructure, high energy costs, and generally poor market conditions have been significant market barriers to development of minerals resources in the area. Development of some known mineral deposits have been precluded by federal land withdrawals. In the past, these factors have prevented further determinations of feasibility of exploitation for many deposits (SWAMC 2003). Mineral development has the potential to expand the AEB economy. In addition, mineral development can have adverse effects to coastal resources and conflict with other uses.

6.9.2.1 Unique Concern

Mineral development, including sand and gravel, is a unique concern to the AEB and its residents. Mining is a unique concern because it can add substantial income to the local economy and diversify the economy. Additionally, sand and gravel mining operations provide essential sources of material for residential and commercial development and transportation facilities. If not managed properly, however, mineral development can significantly impact coastal resources and uses.

Although revisions to the ACMP regulations in 2004 revised the statewide mining standard to only address sand and gravel mining in marine waters, mining may be address through other means. For example, effects of mining projects or subsistence or habitat may be addressed through those statewide standards and associated district enforceable policies.

6.9.2.2 Sensitivity to Development

Many coastal resources and uses are sensitive to mineral development. In addition to direct alteration of habitat, improper disposal of mine tailings and effluent can adversely affect fish and wildlife. These effects are discussed below and in section 6.6.3.3.

6.9.2.3 Effects of Mining and Conflicting Uses

This section discusses conflicting uses between mineral development and other potential adverse impacts from mining.

- **Water Pollution**: Surface and groundwater contamination can result from acid mine drainage, elevation of heavy metals, effluent drainage from tailings impoundments, mixing zones, cyanide solution leaks, seepage from cyanide heap leach processing and waste rock piles, and spills of chemicals and petroleum products used in mining operations. Water pollution can result in direct kills to fish and wildlife.
- **Habitat Displacement:** Mining activities may displace fish and wildlife through alteration of habitat, noise and the presence of activities in areas previously used by fish and wildlife.
- **Dust:** Fugitive dust from uncovered mining operations including trucks transporting ore, can result in contamination of the environment. For example, this has been a problem along the Red Dog Mine road as well as in Skagway from transport of minerals from the Yukon Territory.
- **Water Withdrawals**: Some mining activities require the withdrawal of water from lakes and streams. Such withdrawals can affect fish populations.
- **Sedimentation and Siltation:** Increased turbidity of waters and deposits of sediment on river bottoms can result from mining, especially from placer operations,
- **Subsistence:** Effects on subsistence resources and uses may result from mining activities including increased access from roads and marine transportation facilities and real or perceived pollution.
- **Stream Alterations:** Alternation to stream courses may result in changes to river flow and increased erosion. Water courses may also be diverted to create tailings impoundments.
- **Reclamation:** Inadequate reclamation, including treatment of tailings impoundments can result in long-term environmental problems.
- **Bonding:** Inadequate bonding requirements to ensure reclamation plans are implemented can result in clean up problems, especially if a company goes out of business.
- **Dam Failure:** An improperly constructed tailings impoundment could result in a failure of the dam and exposure of tailings effluent and tailings to the environment.
- **Studies:** Inadequate baseline studies before a project is constructed can lead to problems later when determining the cause of environmental problems.
- **Monitoring:** Inadequate inspections and monitoring of mining operations and enforcement can result in a lack of compliance with permit terms and regulations.
- **Public Involvement:** Inadequate opportunities for citizen and local government involvement in reviews of mining projects can result in a lack of support for mining operations.

Many of these potential problems can be substantially reduced or eliminated through best management practices and adequate plans of operation. The ACMP has played a strong role in the past in ensuring that local governments have a seat at the table during reviews of mining projects.

6.10 Natural Hazards

This section provides an update to the resource inventory and resource analysis. It begins with a discussion of areas designated for natural hazards in the AEB and continues with a supplement to the resource inventory followed by a supplement to the resource analysis.

6.10.1 Natural Hazards Area Designations

The AEB designates separate natural hazard areas for the following hazards: Earthquake Hazard Areas, Volcanic Hazard Areas, Landslides and Avalanches, Flooding, Tsunami and Erosion Hazard Areas. These areas are described in detail in Chapter 7. Although federal lands are not included in this designation, a project requiring a federal consistency determination or federal consistency certification "within or affecting land or water uses or natural resources of the coastal zone is subject to state standards in 11 AAC 112.200 – 11 AAC 112.990 and to applicable enforceable policies of a district coastal management plan approved under 11 AAC 114" (11 AAC 110.015).

6.10.2 Natural Hazards Resource Inventory and Analysis

The resource inventory and analysis have been combined for the discussion of natural hazards because hazards are neither a resource nor a use. A discussion of hazards flows naturally into a discussion of the effects of such hazards. Natural hazards are discussed in the 1984 resource inventory (p. 4), Map B (Appendix E), the 1985 resource analysis (pp. A-3 and B-3).

6.10.2.1 Earthquakes

Tectonic activity is extremely high along the Alaska Peninsula and Aleutians Islands, and some of largest earthquakes on record have occurred here. The Aleutian Trench, one of the most active seismic belts in the world, is located on the south side of the AEB. Earthquakes of a magnitude of magnitude of 6.0 or greater on the Richter scale have been recorded for the region. Most earthquakes of this magnitude occur at depths shallower than 60 km. An earthquake of 8.7 occurred in this area in 1939.

The major concerns for an earthquake are damage to property and loss of human life. Structures may be weakened by ground shaking and subsidence may occur. Development facilities should be designed to withstand earthquake activity. The storage of petroleum products and transportation of them through pipelines are of particular concern.

6.10.2.2 Volcanic Action

The AEB is located in the Pacific Ring of Fire, and many dormant and active volcanoes are located within its boundaries. Movement of Pacific Plate against the Aleutian Trench created the many volcanoes in the region. Of the 11 active volcanoes in or near AEB, 6 are located on Unimak Island. Pogromni, Westdahl, Shishaldin, and Pavlof as considered to have the highest potential for eruption (AECRSA 1984). Volcanoes in the AEB that have been historically active include Akutan (1992), Fisher (1830), Isanotski, Shishaldin (2000), Westdahl (1991), Amak (1796), Dutton, and Pavlof (2001). Veniaminof Volcano, near the eastern boundary of the AEB, last erupted in 2004 (Alaska Volcano Observatory 2005).

http://www.avo.alaska.edu/volcanoes/region.php/atlas.htm) Since 1775, 74 volcanic eruptions on the Alaska Peninsula and Unimak Island (not including volcanoes in Katmai National Park).

Hazards associated with volcanoes include damage from directed blasts, pyroclastic flows, ash fall, lava flow, and mudslides. Airborne ash can damage aircraft engines and sensitive electronic equipment. Ash from the 1978 eruption of Westdahl Volcano ash damaged a U.S. Coast Guard light station. Ashfall can choke streams and suffocate fish. In addition, ash can damage low growing plants by smothering them.

6.10.2.2 Landslides and Avalanches

Landslides and avalanches may occur in areas of the AEB with steep slopes. None of these areas, however, are located near communities. Soil slips are common on steep slopes throughout the region (AECRSA 1984). Map B identifies the areas of high hazard (Appendix E).

6.10.2.3 Flooding, Tsunamis and Erosion

Flooding and erosion has the potential to occur along the coast and along rivers. Although many of the rivers in the AEB are short, there is some potential for flooding. The periodicity of floods in the borough has not been extensively studied. Erosion is an ongoing concern in the AEB. For example, the Village of Nelson Lagoon has installed bulkheads along the lagoon side of the village to prevent damage from wave action. Coastal flooding results from wind and tide driven storm surges or tsunamis.

Tsunamis are a concern in some parts of the AEB. False Pass, Cold Bay, King Cove, and Sand Point have been rated to have local tsunami hazards, which means a tsunami could reach the communities before a warning could be issued. A moderate distant tsunami hazard exists for Cold Bay and False Pass, and a high distant tsunami hazard exists for King Cove and Sand Point (AECRSA 1984). The 1946 earthquake on Unimak Island resulted in a 100-foot tsunami that toppled Scotch Cap lighthouse. In 1957, a 45-foot wave occurred at the same location. Earthquakes in this region generated tsunamis as far as California and Hawaii. Storm waves are most dangerous for areas west of Unimak Island and south of the Sanak Islands and Shumagin Islands. Storm waves are most likely to occur winter (February) and fall (November).

The greatest potential for erosion from water occurs in areas with loamy soils, both in coastal plains and where it occurs on slopes. Cindery soils have low potential for erosion even on steep slopes.

Wind erosion can occur anywhere in the borough where soils are exposed. High winds occur throughout the year in the AEB. Coastal dunes are always susceptible to wind erosion.

6.10.2.4 Climate Change

Climate change is a unique concern to the AEB and its residents because the effects of climate change could lead to increased erosion, changes in the numbers and distribution of fish and wildlife, and the viability of subsistence and commercial fishing activities. While it may not be possible to affect global warming patterns at the local level, the AEB can ensure that applicants for development projects include appropriate designs to respond to the effects of climate change.

Archaeological evidence reveals that there was a two-meter drop in relative sea level in Unalaska Bay that occurred about 3,000 years ago. While experts do not agree on the exact cause of this sea level drop, there is some evidence that it was due to climate change (Knecht et al. 2001). This change likely resulted in a major change to the Bering Sea ecosystem. As well, similar raised shorelines are evident on Kodiak Island and Afognak Islands (Carver et al. 2000; Carver 1993; and Gilpin 1995).

While some historical changes in climate have resulted from natural causes and variations, there is worldwide scientific consensus that the global temperature is rising at a rate unprecedented in the experience of modern human society (ACIA 2004). The scientific community continues to gather evidence about climate change and currently experienced and expected effects on the habitats and the biota upon which humans and other living creatures depend. Biological responses to temperature change can be studied by examining historical episodes of warming and cooling, both temporary and long-term. Impacts of the current climate shift, which is expected to continue and even accelerate, are already in evidence in many parts of the globe, but particularly in northern latitudes.

Rising global temperatures are expected to trigger impacts to marine and other ecosystems, including many that will affect the resources and uses in the coastal zone of Alaska. Impacts that can be expected to affect the AEB include a rise in sea level, changing wind and deep-ocean circulation patterns, ocean stratification and resource productivity, shifts in species distributions, outbreaks of disease and harmful algal blooms. The number of variables and unknowns make it impossible to predict the timing, duration or severity of specific impacts, the one °C rise over the past century and the expected three °C over the next century will cause effects such as those briefly discussed below.

Climate change has the potential to affect marine fisheries significantly. Most fish have a fairly narrow range of optimum temperatures related both to the species basic metabolism and the availability of prey species that have their own optimum temperature ranges. A species' range may expand, shrink or be relocated as a result of changes in ocean conditions (NOAA website 2005). The shift in predator-prey relationship may result in a die-off, even a crash in the population of a particular species.

For instance, the distribution of sockeye salmon is limited by water temperature. Sockeye can withstand a warmer summer temperature, but their metabolism slows in winter. Because the warmer winter water temperature causes an increase in metabolism, the fish require larger amounts of food. If sufficient food is not available, the fish starve. If the fish move down into deeper water, they must move back up the water column periodically to feed. If they migrate farther north, they are far removed form the freshwater systems in which they spawn (Matthews-Amos and Berntsen 1999; Finney, et al. 2000).

Capelin were the dominant prey of seabirds in the Gulf of Alaska in the 1970s, but were reduced in seabird diets a decade later. Scientists from the U.S. Fish and Wildlife Service, University of Alaska and the U.S. Geological Survey concluded that the change in the diet of seabirds in the Gulf to sand lance and pollock resulted in harmful effects to a variety of seabird species – before the *Exxon Valdez* oil spill. Populations of black-legged kittiwakes, common murres, cormorants, Kittlitz's murrelets, horned puffins and others declined. The breeding success of black-legged kittiwakes declined dramatically (Meehan et al. 2003).

Seabirds are vulnerable to global warming in several other ways. A rise in sea level will destroy nesting habitat for birds that colonize shorelines, those nesting in burrows may be flooded, an

increase in storms may result in higher chick mortality, and water conditions, such as turbidity, salinity, currents, nutrients or depth, may affect survival. However, some bird species may prosper under the shift in climate, particularly if the changes enhance their specific food supply (Meehan et al. 2002).

During the 1982-3 El Niño, there was a decline in some populations of seals and sea lions which has been attributed to the temperature shift. Changes in water circulation patterns, loss of available food fish due to a drop in phytoplankton, and the migration of the affected seals and sea lions to cooler waters (and farther from prey) contributed to the decline (NOAA website 2005).

6.10.2.5 Implications of Natural Hazards

The high potential for earthquakes, volcanic eruptions and tsunamis in the AEB underscores the need for adequate planning and design of coastal development. As well, flooding, erosion, landslides and avalanches pose potential problems for development. Construction in certain areas may be inappropriate due to the potential for damage from these natural hazards. Of special concern is the potential for spills of petroleum products resulting from inadequate storage of products and from oil and gas exploration or production facilities.

6.11 Recreation

This section begins with a description of areas designated for recreation under 11 AAC 114.250 followed by an update to the resource inventory and resource analysis. Additional information about recreation may be found in the 1984 resource inventory (p. 28), the 1985 resource analysis (pp. 28 and 113), and the 1992 supplement to the CMP (p A-15).

6.11.2 Recreation and Tourism Resource Inventory

A project initiated by the AEB in 1997 evaluated the tourism potential for 5 communities in the borough: Sand Point, King Cove, False Pass, Akutan, and Cold Bay. The project involved workshops in each of these communities as well as an inventory of attractions. Nelson Lagoon chose not to participate in the project due to a lack of interest in developing tourism, but some people in the community have recently become interested in expanding the economy through limited tourism. Unless otherwise noted, the information in this resource inventory is from that study (AEB 1998).

Although currently undeveloped in the borough, tourism has the potential to expand the economy. It has the 3rd largest impact on the Alaska economy after oil and gas and seafood. The high costs of transportation and the lack of infrastructure and marketing are obstacles to expanding this sector. The area's unique attractions, however, may attract "niche visitors," especially those who have traveled to Alaska previously.

6.11.2.1 Market

Currently, business travelers represent the bulk of visitors to the area (DCED 1997). These travelers often participate in additional tourism activities that they did not include before they began their trips. Most vacation or pleasure trips are related to hunting and fishing activities. There has been a modest growth in cruise ship visits to the area, especially to Sand Point and

Cold Bay. These visits involve small cruise ships and larger ships during positioning cruises to the Far East.

A survey completed by the Southwest Alaska Municipal Conference found that the typical visitor to Southwest Alaska is a second time traveler to Alaska, college educated, and between the age of 40 to 50. Only 11% of the visitors to Southwest Alaska, however, traveled to the Aleutian Islands (DCED 1997). The most common activities of the visitors include photography, day trips, hiking, wildlife viewing, and experiencing Native culture.

A number of strategies have been suggested to expand the market to "niche visitors" interested in birding, wildlife viewing, ecotourism, and heritage tourism. Specific strategies identified include the following:

- Target airline employees and frequent flyer travelers,
- Partner with other organizations such as the Southwest Municipal Conference and Unalaska-Dutch Harbor Convention and Visitors Bureau,
- Encourage longer port visits by the Alaska Marine Highway vessels,
- Expand opportunities for intra-region air transportation,
- Develop air-sea packages (similar to those used in other rural regions of Alaska),
- Establish additional museums (e.g., a military museum in Cold Bay), and
- Convert unused buildings into tourism facilities (e.g., the former fish hatchery in Cold Bay.

Cold Bay has a potential to become an air hub for the entire Aleutian Islands. The AEB is currently seeking funds to construct a larger air terminal that could accommodate more passengers than the existing terminal.

The major challenges to tourism development include the cost of transportation, the lack of infrastructure, and the lack of a unified vision for tourism development in the individual communities. Visitors expect certain basic services such as restrooms, lodging, camping areas, trash disposal, interpretive signs, and food service. In addition, without adequate customer service training, expectations of visitors may not be realized.

Ecotourism is an area that shows promise for expansion. This type of experience focuses on teaching environmental preservation values and practices.

6.11.2.2 Attractions

Visitors are attracted to the region because of its physical beauty of the region, its history, and opportunities for sport fishing, hunting, wildlife viewing and other outdoor activities. The environmental is characterized by windswept mountains and a nearly treeless landscape. Five species of salmon, halibut, crab, pollock and other fish populate the waters. Several volcanoes in the borough are part of the Pacific Ocean's "Ring of Fire."

Almost every community offers opportunities for beach coming, hiking, fishing, wildlife viewing, and hunting and fishing. World-class birding opportunities exist in most areas of the borough. The national wildlife refuges, historic sites, active volcanoes, and the strong Aleut culture are of interest to visitors. A brief discussion of each community follows.

Akutan: Akutan is located on one of Krenitzin Islands in the western end of the borough. It was established in 1878 as a fur storage and trading post. Between 1912-1942, the only whaling station in the Aleutians was located in this community. During WWII, it became a strategic military site, and residents were evacuated to Ketchikan.

The only way to travel to Akutan is by boat or by amphibious aircraft from Unalaska. There are no roads, but the community has a system of boardwalks. The community has a museum, nearby hot springs, the 4,275-foot Akutan volcano, and the Alexander Nevsky Chapel, a Russian Orthodox church was constructed in 1918. Other potential attractions include a former sulfur mine, a light house and opportunities to view wildlife including minke and pilot whales, orcas, porpoise and rare birds such as the whiskered auklet and the ancient murrelet. There are also wild cattle on the island. The community hosts one of the largest onshore fish plants in Alaska. Old village sites on nearby Avatanak and Akun Islands may also be a potential attraction. There is a hotel available with limited space, and meals can be arranged through the local fish processing plan.

Cold Bay: Located in the Izembek National Wildlife Refuge, Cold Bay is a former military site located in an area formerly inhabited by a large Native population. The largest eelgrass system in North America is located near the community. The area was used by European hunters and trappers throughout the 19th century. During WWII, Cold Bay was the site of Fort Randall, an important air base. Access to the community is available through daily air service from Anchorage, by boat or by monthly Alaska Marine Highway ferry service between May and October.

Attractions include the three volcanoes that may be viewed from the community including local Mr. Frosty and Mt. Pavlof and Mt. Shishaldin. The military history, including the remains of the WWII base and evidence of Russian occupation, and Native culture provide historic interest. Sport hunting and recreational fishing is available through local guides. There are over 140 species of birds that use the area, and scenic overlook shelters are located at Grant Point and Izembek Lagoon. Roads through portions of the Izembek National Wildlife Refuge provide a unique access because few refuges have roads. Festivities over the Labor Day weekend include a Silver Salmon Derby, a polar bear dip and a community potluck. Also, there is potential to convert the former fish hatchery into a tourist facility.

Some infrastructure exists in the community including a hotel, lodge, dining facilities, rental car facilities, and a store. The dock is able to accommodate cruise ships.

Sand Point: Founded by Russians in the 1870s, Sand Point later became a cod fishing station. Scandinavian fishermen joined the Aleut population. During the early 20th century, Sand Point became a repair and supply center for gold miners. During the 1930s, fish processing gained in importance.

Sand Point hosts the largest fishing fleet in the Aleutians. A major bottomfish and salmon processing plant employs many residents. There is daily jet service to Anchorage, and monthly ferry service between May and October. Cruise ships occasionally stop in the community. There are 5 restaurants, a hotel and a bed and breakfast. Some of the residents hold 6-pack licenses, local charters are available, and there are local guides.

The area provides numerous attractions including a petrified forest, an agate beach, a wild bison herd, and several old gold mines. The petrified forest, located on the western side of Unga Island, is thought to be 25 million years old, and some of the stumps are 9 feet in diameter (Joling 2004,

Eakins 1970). Historic resources include the St. Nicholas Russian Orthodox church and the abandoned Unga Village on Unga Island.

King Cove: The community of King Cove was founded in 1911 with the establishment of a salmon cannery. Early settlers included Scandinavian and Aleut fishermen. It is currently one of the largest communities in the Aleutians with a large fish processing plant.

Access is provided mostly by air with monthly ferry service May through October. Upon completion of the road-ferry link to Cold Bay, the community will become more accessible. King Cove is located near the Alaska Peninsula National Wildlife Range, and there are views of Mt. Pavlof and Mt. Shishaldin visible from town. The community, however, is not united in its support for tourism.

False Pass: False Pass is a small community located on east end of Unimak Island. It is located within the Alaska Maritime National Wildlife Refuge. It is an important refueling stop for commercial fishermen.

Access to the community is provided by air with "whistle-stop" ferry service May through October. There is tourism potential for sport fishing, hunting, hiking and wildlife viewing. Daytrips would include flightseeing tours of the local volcanoes. Other attractions include hiking opportunities to views of both the Bering Sea and Pacific Ocean, bamboo fossils, and abandoned Aleut villages with earth dwellings called barabaras. Most community members appear to support expanding tourism development. Although there are no hotels, bed and breakfast arrangements can be made.

Nelson Lagoon: The community of Nelson Lagoon is a small community located on a thin peninsula between the lagoon and the Bering Sea. There are hotels in the community but no stores or restaurants. Although the community did not participate in the 1997-1998 tourism study, some members of the community support limited tourism development. Some residents provide guiding services to hunters.

6.11.3 Recreation and Tourism Resource Analysis

The resource analysis begins with a statement of why recreation and tourism are a unique concern to the AEB and its residents followed by a discussion of the sensitivity of this use to development. The resource analysis ends with a discussion of potential conflicts and affects from tourism and recreation activities.

6.11.3.1 Unique Concern

Tourism and recreation is a unique concern to the AEB and its residents for several reasons. First, local residents use the areas in the borough for recreational hunting, fishing, hiking, and camping. Second, the tourism and recreation sector has the potential to diversify the economy. Third, an expansion of tourism and recreational activities has the potential to conflict with other uses and disrupt local residents.

6.11.3.2 Sensitivity to Development

Many areas used for recreation and tourism are extremely sensitive to development. Areas particularly sensitive to development are discussed in Section 6.6.3.2. Recreation and tourism

activities are sensitive to competing uses that affect the quality of the experience, including disruption to viewsheds, noise disturbance and blockage of access.

6.11.3.3 Competing Uses

Tourism and development of recreational opportunities have the benefit of expanding the economy through provision of local employment and purchases of goods within the communities. Tourism can compete with other uses, however, and impact communities and coastal resources.

Local Employment: Tourism jobs are typically low paying and seasonal in demand during the same period as local commercial fisheries openings. Many regions in Alaska report that lodges often employ people from outside the region with little local benefit. Local hunting and fishing guides in the AEB, however, are reaping some benefits of the visitor industry.

Competition with Subsistence: An increase in sport hunting and fishing by people from outside the region has the potential to compete with subsistence users. Given likely scenarios for expansion of recreational hunting and fishing, local populations of fish and wildlife would not likely be significantly affected. Specific areas used by residents, however, could receive additional pressure.

Access: Development in remote areas can affect recreation by reducing access, altering viewsheds, or degrading the recreation experience. When public land is transferred into private ownership and when private land used for recreation is developed, important access to backcountry areas can be affected. As well, development can have both positive and negative effects to recreation experiences. For some recreational users, manmade development can augment a recreation experience such as ATV trails, old cabins, mining ruins, and former cannery sites. For enthusiasts who enjoy a wilderness or back country recreational experiences, any change to a viewshed or the landscape might be considered an adverse impact.

Trespass: Trespass by recreation users on private land, including Native allotments, can conflict with local users. Unauthorized use of private lands provides a conflict as well as other effects such as vandalism or littering.

Conflicting Recreational Uses: Certain types of recreation can conflict with other types of recreation. For example, some non-motorized recreation users object to any motorized use of trails. Other impacts from recreation use include an increase in litter, improper disposal of human waste, overuse of trails leading to soil degradation, and the effects of increased use on the backcountry experience.

Wildlife Conflicts: Recreation has the potential to conflict with fish and wildlife through over-hunting of specific populations or by over use of an area. At some point, increased presence of visitors may displace animals. Overuse of camping spots or trails can result in erosion and compaction of soil. In addition, as areas frequented by bears become more highly used by humans, there is a potential for a conflict resulting from the need to defined life or property.

6.12 Transportation and Utility Facilities

This section supplements the original 1984 resource inventory (pp. 24-26) and the 1985 resource analysis (pp.21-23, 33-72, and 101-105).

6.12.1 Resource Inventory

An impressive number of improvements have been made to the marine, air and land transportation systems in the AEB since the original plan was written. The borough has had an aggressive capital improvement program for transportation facilities including docks and small boat harbors. Air transportation has had some disappointments as well as some improvements. While the cost of traveling to the communities is still very high, planned and completed improvements to the airports will allow larger aircraft to service the communities. The Alaska Marine Highway Service provides vehicle and cargo service between Kodiak and all AEB communities except Nelson Lagoon. These improvements are discussed in more detail in the remainder of this section.

6.12.1.1. Air Transportation

The limited road systems in Southwest Alaska and lack of year-round passenger boat service make air transportation extremely important. Today, air transportation is the only practically means of traveling outside of the region as well as between communities in the borough.

The discontinuation of jet service between Unalaska and Anchorage in 2004 has the potential to benefit the AEB. Improvements to the airport in Sand Point have resulted in limited jet service to Anchorage. Cold Bay has the state's third longest runway, and it has the potential to become a regional air hub for the Aleutians. A former airbase, Cold Bay has a 10,415-foot paved airstrip with a 5,125-foot crosswind runway. Construction of a larger passenger terminal will increase the attractiveness of the airport. Currently, Cold Bay serves as a base for medical evacuations as well as an alternate airport for Anchorage's airport in the event of emergencies. The community has demonstrated it ability to accommodate a large number of visitors during recent instances where aircraft have been diverted to its airport.

A higher percentage of freight is flown into Southwest region than any other part of the state. The bypass mail system provides an affordable way to deliver 4th class mail directly to the communities without going through the post office. Sandpoint gets mail directly from Anchorage.

The Alaska Aviation Coordination Council adopted a minimum standard is 3,300 feet for public rural access. Expansion of Sand Point airport in 2005 has resulted in the initiation of jet service. Cold Bay and Nelson Lagoon have adequate runway lengths, but the other communities need improvements to their airports. The King Cove airport is located in mountainous terrain, and in some year, it is inaccessible 50% of time. Congress appropriated $15 million for improvements to the King Cove Airport to allow jet aircraft to fly non-stop to and from Anchorage in 1998. The runway at False Pass is currently 2,100, but terrain limitations make it difficult to extend. Akutan currently has a seaplane base, but the amphibious aircraft that links the community with Unalaska may become obsolete in the near future. Plans are being considered to construct a road to a new airport site.

6.12.1.2 Marine Transportation

Marine transportation provides an important means to deliver freight to the communities of the AEB. In addition, seasonal services of the Alaska Marine Highway System provides access to Sand Point, King Cove, Cold Bay, False Pass, and Akutan. The service involves about 7 round trips each year between Kodiak and Unalaska. The 2002 Southwest Transportation Plan proposed improvements to the service by increasing the number of trips to the southern communities of the

Alaska Peninsula and the Aleutian Islands (Parsons Brinckerhoff 2002). Expansion of service to Southwest Alaska would likely result in a need for a 40% subsidy

Most of the communities have marine transportation infrastructure, although improvement to the system are needed. Sand Point has a 25-acre boat harbor with 4 docks and 140 slips. A second boat harbor will be constructed soon near the ferry terminal. Occasionally, cruise ships stop in Sand Point and Cold Bay. Cold Bay has a 260-foot dock, but no boat harbor. It will soon be linked to King Cove through a hovercraft across the bay to a new 17-mile road to the community of King Cove. In King Cove, Peter Pan fisheries has 3 docks, and there is also a city dock. False Pass provides an important refueling stop to the Bristol Bay and Bering Sea fishing fleets. It has whistle-stop ferry service May – October.

6.12.1.3 Land Transportation

Although several communities have limited road systems, there are no plans to connect the communities in the borough to areas outside the region. In addition to the road systems within each community, a new road-hovercraft route will link the communities of Cold Bay and King Cove. Trails exist between Point Moller and Balboa Bay and between Nelson Lagoon and David River.

After a long review process, a new road connecting King Cove to a hovercraft link to Cold Bay was finally constructed in 2005. Original plans for an all-road corridor received opposition because part of the route Because the area near Cold Bay would have been located in a portion of the Izembek National Wildlife Refuge that is designated as wilderness. In 1998, Congress appropriated $20 million under the King Cove Health and Safety Act to construct the link to Cold Bay after a plan for the road failed to receive approval. A final Environmental Impact Statement was completed in December 2003, and during January 2004, the U.S. Army Corps of Engineers issued its permits for the road (AEB 2005).

The link involves a 17-mile road from King Cove to the northeast corner of Cold Bay. The road is less than 20-feet wide, and it provides a one-lane, two-way gravel road. As required under the King Cove Health and Safety Act, the road has been constructed entirely on village corporation land. The marine link crosses Cold Bay to a landing about three fourths of a mile south of the City of Cold Bay dock.

The hovercraft, a newly built BHT130, extends 90 feet long and 42 feet wide. It will hold up to 50 passengers and accommodate an ambulance to facilitate emergency transport to the Cold Bay airport. This new link will provide a safer way for emergency transport. Over recent years, a number of deaths have occurred during medical evacuations.

6.12.2 Resource Analysis

The resource analysis begins with a discussion of why transportation and utilities are a unique concern to the AEB. It continues with a discussion of areas sensitive to development, and it ends with a description of conflicts between transportation and utility corridors and other uses.

6.12.2.1 Unique Concern

Utility and transportation corridors are a unique concern to the AEB and its residents.

Transportation development is vital to the well being of the borough and its residents, but these developments may also conflict with other uses. Development of new roads can disrupt habitat, change drainage patterns, inhibit fish and wildlife migration, and open up previously remote areas to other uses.

6.12.2.2 Sensitivity to Development

Fish and wildlife, habitat, subsistence, and recreation are sensitive to effects from transportation facilities. Aircraft have the potential to disturb wildlife. Roads can disrupt natural water flows and adversely affect fish and wildlife habitat. Roads may also result in new sources of noise and disturbance from traffic to wildlife populations and to subsistence activities. Section 6.6.3.2 includes additional discussions about sensitive environments.

6.12.2.3 Conflicting Uses and Adverse Effects

Construction of transportation and utility facilities can have significant effects to coastal uses and resources. Roads result in physical changes to the habitat itself by displacing animals and disrupting migration paths. Proper mitigation at the time of construction can reduce costs incurred later to address problems.

Roads produce noise which can affect some animals. Roads also change drainage patterns and improperly placed culverts can be a barrier to fish migration, especially young coho salmon that use small tributaries for rearing. Erosion and runoff can result during road construction leading to increased suspended solids in water bodies. In addition, roads provide access for hunters and fishermen to areas previously not easily accessible. This access can lead to new pressures on fish and wildlife populations.

Other utility facilities also affect coastal resource and uses. Hydroelectric projects can affect coastal resources by altering stream flows and blocking fish passage. Impounded water bodies will change the habitat. Utility corridors for pipelines and transmission lines can disrupt wildlife migration. Facility construction can damage or destroy unmarked graves, archaeological sites and historic sites.

6.13 Major Land Ownership

The major landowners in the AEB are the federal and state governments and the Native corporations. Since the original CMP was written, more private land has become available in the borough. New settlement in remote parcels of land has the potential for increased impacts to coastal habitats and resources.

6.13.1 Borough Lands

The AEB received the remainder of its 7,633-acre entitlement in 2005 from the State of Alaska under the municipal entitlement program. These lands include areas on the Sandy River, an area bordering Bear Lake, an area along the coast near David River, and an area adjacent to Pavlof Bay. About one quarter of its entitlement was conveyed in the mid-1990s.

Table 6-10: Population of the Aleutians East Borough, 2004 estimate

City	Population
Sand Point	947
King Cove	723
Cold Bay	89
Akutan	771
False Pass	62
Nelson Lagoon	76
Total AEB	2668

Source: DCCED

Additional information about these communities from the Alaska Department of Commerce Community and Economic Development is included in Appendix A.

6.13.2 State Lands

The state owns title to tidelands, shorelands and some uplands within the AEB (DNR 2004). The State of Alaska management units within the AEB include portions of units 1 and 18 and all of units 19 – 22. A brief description of state lands and management in each of these areas is described below.

Region 1: This unit includes offshore state waters along the Bering Sea side of the Alaska Peninsula and islands. The area plan does not include a discussion of the management objectives for this unit.

Region 18: This unit includes upland and tideland areas in the eastern part of the AEB and western part of the Lake and Peninsula Borough. There are nine cultural and historic sites located around Port Moeller, Bear Lake and the Seal Islands. The area has a high potential for oil and gas, and the one well drilled in the unit, Sandy River No.1, has showing of oil and gas. Minerals include placer deposits of iron, titanium, manganese and gold and a few copper, lead and gold prospects at the headwaters of the Bear Lake drainage. Most of the region is considered caribou calving grounds and moose calving areas are located near the Bear Lake and Port Moller areas. Areas managed for habitat include the Cape Seniavin, Bear Lake, and Seal Islands. An area near Bear Lake is designated for settlement.

Region 19: This unit includes Herendeen Bay, Port Moller and the Shumagin Islands. Most of this unit is in federal ownership, but the state owns the tidelands, shorelands, and uplands at the heads of Herendeen Bay and Port Moller. This area includes at least 106 cultural and historic sites. The mineral potential for this unit is high with about 100 mineral occurrences (silver-gold, gold, copper, copper-molybdenum, and lead-zinc). The Herendeen Bay coal field is located in this area as well as the Pyramid prospect; Apollo, Sitka and Shumagin mines on Unga Island; and the Centennial prospect. The area has modest potential for oil and gas in the area between Port Moller and Herendeen Bay. Commercial fishing is an important use of this area. An area for settlement has been designated near Herendeen Bay, and areas designated for habitat include Nagai Island and Port Moller, and the tidelands adjacent to the national wildlife refuges.

Region 20: The Port Moller Critical habitat Area is located in this unit. The area plan does not include a discussion of the management objectives for this unit, but management direction is established in the statute that created this area.

Region 21: This region includes Nelson Lagoon and Moffet Lagoon. State lands include 484,697 acres or uplands and 495,999 acres of tidelands. Most of the lands within 10-15 miles of the coast are state owned. The primary use of the land is for subsistence. There is one prehistoric site identified on the west side of Herendeen Bay. There are 11 known mineral sites including copper, gold, silver, lead, zinc, antimony, arsenic, and silver ore. Part of the Hereneen coal field is located in this region. Oil and gas potential is considered high, and previous drilling encountered oil and gas was encountered in some of the wells. A large caribou calving area is located in most of the lowlands west of Nelson Lagoon and north of the mountains. The area includes sensitive habitat for marine mammals, seabird colonies, and harbor and walrus haulouts. Areas designated for habitat include Port Moller Critical Habitat Area, Port Moller West, Port Moller Bay, and the tidelands adjacent to the Alaska Peninsula National Wildlife Refuge. The unit near Salt Water Lagoon is designated for settlement.

Region 22: This region includes the western part of the Alaska Peninsula, Unimak Island and the Krenitzin Islands. Three wildlife refuges are located in the region including the Izembek, Maritime and Alaska Peninsula refuges. Other than the tidelands and shorelands, there are only a few areas of state land near the communities of Cold Bay, False Pass, Akutan, and King Cove. There are 157 archaeological and cultural sites in the region. Commercial fishing and fish processing are an important part of the economy for this part of the borough. There are 36 mineral sites, mostly gold and silver, and oil and gas potential is unknown. Units designated for habitat include the tidelands adjacent to the national wildlife refuges. State land around Cold Bay is designated for settlement.

6.13.3 Federal Lands

Federal Lands occupy much of the AEB. The U.S. Fish and Wildlife Service (USFWS) manages most of the land within three national wildlife refuges. The entire 417,533-acre Izembek National Wildlife Refuge is located entirely in the borough. About 300,000 acres of the refuge was designated as a wilderness area in 1980 under the Alaska National Interest Lands Act. A small part of the Alaska Peninsula National Wildlife Refuge is located in the northeast corner of the borough, and some of the islands within the AEB are included in the Alaska maritime National Wildlife Refuge.

6.13.2 Private Lands

The vast majority of private lands in the AEB are owned by the regional and village Native corporations. The Aleut Corporation, the regional corporation, was awarded $19.5 million and 66,000 acres of surface lands and 1,572,000 acres of subsurface estate on the Alaska Peninsula, Aleutian Islands and the Pribilof Islands. Native lands in the borough include areas on the peninsula west of Port Moller and on the Shumagin Islands (Aleut Corporation 2004).

6.17 List of References

ACIA. 2004. *Impacts of A Warming Arctic*. Arctic Climate Impact Assessment. Cambridge University Press. UK.

ADFG/BOF. 1998. *Board of Fisheries Adopts Abundance Based "Chum Cap" in June Area M Fishery.* Alaska Department of Fish and Game. Board of Fish. Press release. 01/21/98.

ADFG/CFD. 2005. Website. Alaska Department of Fish and Game. Commercial Fisheries Division. http://www.cf.adfg.state.ak.us.

ADFG/DWC/ES. 2005. Alaska Department of Fish and Game website. Division of Wildlife Conservation/Endangered Species page. http://www.wildlife.alaska.gov./aawildlife/endangered/concern/

ADFG/GMU. 2005. Website. Alaska Department of Fish and Game. Division of Wildlife Conservation. Game Management Units. http://www.wildlife.alaska.gov/index.cfm?adfg=regulations.hunting

ADFG Community Profile Database. 2005. Alaska department of Fish and Game. Division of Subsistence. http://www.subsistence.adfg.state.ak.us/

Adkinson, Milo D. and Bruce P. Finney. 2003. *The Long-Term Outlook for Salmon Returns to Alaska.* Alaska Fisheries Research Bulletin. Vol. 10, No.2. Juneau.

AEB (Aleutians East Borough). 2005. *Preparing for oil and gas development in the Aleutians East Borough: Potential benefits and impacts.* Prepared by Glenn Gray and Associates and Environmental Solutions. Juneau.

AEB (Aleutians East Borough). 1998. *Aleutians East Borough tourism evaluation.* Prepared by the AEB with the Southwest Municipal Conference Sand Point.

AEB (Aleutians East Borough). 1992. Aleutians East Borough Coastal Management Program Coastal Area Boundary, Policies, Implementation, Resource Inventory and Analysis, November 1992 (Reprinted April 1993).

AEB. Undated. Aleutians East Borough: A prospectus for the future.

AECRSA (Aleutians East Coastal Resource Service Area). 1985. Volume I: Aleutians East Coastal Resource Service Area Conceptually Approved Coastal Management Plan.

AECRSA (Aleutians East Coastal Resource Service Area). 1984. Volume II: Resource Inventory for the Aleutians East Coastal Resource Service Area Conceptually, April 1984 (Reprinted June 1986).

AECRSA (Aleutians East Coastal Resource Service Area). 1985. Volume III: An Analysis of Potential Development and Environmental Sensitivity in the Aleutians East CRSA, July 1985.

AECRSA (Aleutians East Coastal Resource Service Area). 1985. Map 1, Coastal Area Boundary and Special Use Areas.

AECRSA (Aleutians East Coastal Resource Service Area). 1984. *Aleutians East Coastal Resource Service Area program: The Shetland Islands experience.* Aleutians East Coastal Resource Service Area. Sand Point.

ADFG (Alaska Department of Fish and Game. 1999. Most Environmentally Sensitive Area (MESA) map series. Anchorage.

ADFG (Alaska Department of Fish and Game). 1985. *Alaska habitat management guide: Southwest region*. Vol. III. Human Use of Fish and Wildlife.

ADFG (Alaska Department of Fish and Game). 1983. Alaska's Wildlife and Habitat.

Alaska Volcano Obervatory 2005. Website: http://www.avo.alaska.edu/volcanoes/region.php/atlas.htm

Aleut Corporation. 2004. *The Aleut Corporation: Shareholder mail survey looking back.* Anchorage.

APICDA 2006/08 CDP. 2005. *Aleutian Pribilof Island Community Development Association 2008-2008 Executive Summary.* Community Development Plan for the CDQ. Unalaska.

Barbeaux, Steve, James Ianelli, and Eric Brown. (2004) *Stock Assessment of Aleutian Islands Pollock.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Alaska Fisheries Science Center. Anchorage.

Behnke, Steven and Barbara Sheinberg. 1997. *How subsistence concerns are handled in rural coastal district implementation: Four case studies.* Prepared for State of Alaska Department of Community and Regional Affairs. Prepared by Steven Behnke and Associates and Sheinberg and Associates.

Bergstrom, Daniel J., and Craig Whitmore. 2004. *Kuskokwim River Chinook and Chum Salmon Stock Status and Action Plan*. Alaska Department of Fish & Game. Division of Commercial Fisheries. Anchorage.

Bisson, P.A. and R.E. Bilby. 1982. *Avoidance of suspended sediment by juvenile coho salmons.* North American Journal of Fisheries Management 2(4):371-374

Black, Lydia; McGowan, Sarah; Jacka, Jerry; Taksami, Natlia; and Miranda Wright. 1999. *The history and ethnohistory of the Aleutians East Borough*. Limestone Press. Fairbanks.

Carver, G. A., Knecht, R. A., Davis, R. S., Saltonstall, P., and Sauber, J., 2000, Holocene sea level changes and resettlement of maritime people in the eastern Aleutian and Kodiak Islands, Alaska, EOS, v.81, no.48, p. F6.

Casillas, Ed. 1999. *Role of the Columbia River estuary and plume in salmon productivity*. Symposium on Ocean Conditions and the Management of Columbia River. Salmon Proceedings of the July 1, 1999 Symposium. Portland, Oregon.

Carver, G. A., 1993, Comparison of Paleoseismic Geology of Subduction Zone Earthquakes in Alaska and Cascadia, in Wesson, R. L., and Miyazaki, Y., Proceedings of the Eight Joint Meeting of the U.S.- Japan Conference on Natural Resources (UJNR) Panel on Earthquake Prediction Technology, U.S. Geological Survey Open-File Report 93-542, p. 23.

Chary, Lynn Katz, Principal author and researcher. 2000. Persistent Organic Pesticides (POPs) in Alaska: What Does Science Tell us? Circumpolar Conservation Union

and Tides Center. San Francisco.

DCCED (2005) Alaska Department of Commerce, Community, and Economic Development. Alaska Economic Information System website. Juneau. http://www.commerce.state.ak.us/dca/AEIS/AEIS_Home.htm

DCED (Alaska Department of Community and Economic Development). 1997. *Rural Alaska tourism infrastructure needs assessment: Aleutian and Pribilof Islands*. Prepared by the Alaska Department of Commerce and Economic Development Divisions of Trade and Development and Tourism and the Southwest Alaska Municipal Conference.

DCED (Alaska Department of Community and Economic Development). 2002. *An Assessment of the Socioeconomic impacts of the Western Alaska Community Development Quota Program.* Prepared by Northern Economics. Anchorage.

DCED (Alaska Department of Community and Economic Development). 2002. *An Assessment of the Socioeconomic Impacts of the Western Alaska Community Development Quota Program*. Anchorage.

DEC (Alaska Department of Environmental Conservation). 2004. Geographic Response Strategies for Aleutians, Alaska. http://www.dec.state.ak.us/spar/perp/grs/ai/home.htm

DEC (Alaska Department of Environmental Conservation) and U.S. Coast Guard. 1999. *Aleutians Subarea Contingency Plan for oil and hazardous discharges/releases: A subarea plan of the united plan for the State of Alaska.*

DEC (Alaska Department of Environmental Conservation). 2005. *Geographic response strategies for Aleutians Subarea.*

DNR (Alaska Department of Natural Resources). 2005. Preliminary best interest finding, Alaska Peninsula Areawide Lease Sale. Division of Oil and Gas. Anchorage.

DNR (Alaska Department of Natural Resources). 2004. *Public Review Draft: Bristol Bay Area Plan for state lands*. Alaska Department of Natural Resources. Adopted April 19, 2005. Anchorage.

DNR (Alaska Department of Natural Resources). 2004. *Alaska Peninsula areawide oil and gas lease sale and Bristol Bay basin exploration license area information and data compilation.* Division of Oil and Gas. Anchorage.

Denlinger, Lynn and Kenton Wohl, Editors. 2001. *Seabird Harvest Regimes in the Circumpolar Nations. Conservation of Arctic Flora and Fauna* (CAFF) Technical Report No.9. Anchorage.

Eakins, Gilbert. 1979. *A petrified forest on Unga Island, Alaska.* Division of Mines and Geology, Alaska Department of Natural Resources. Special Report No. 3.

Ellanna, Linda J., Gorge K. Sherrod, and Steven J. Langdon. 1985. *Subsistence Mapping: An Evaluation and Methodological Guidelines.* Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 125. Juneau, 1985.

Eggers, Doug. 2005. *Run Forecasts and Harvest Projections for 2005 Alaska Salmon Fisheries and Review of the 2004 Season.* Alaska Department of Fish and Game. Divisions of Sport Fish and Commercial Fisheries. Special Publication No. 05-01. Juneau.

Fall, James A., Robert J. Walker, and Ronald T. Stanek. 1990. *Subsistence Use of the Southern Alaska Peninsula Caribou Herd.* Alaska Department of Fish and Game. Division of Subsistence. Technical Report No. 191. Juneau.

Fall, James A., David B. Anderson, Louis Brown, Michael Coffing, Gretchen Jennings, Craig Mishler, Amy Paige, Charles J. Utermohle, and Vicki Vanek. 1993. *Noncommercial Harvests and Uses of Wild Resources in Sand Point, Alaska, 1992.* Alaska Department of Fish and Game. Division of Subsistence. Technical Report No. 226. Juneau.

Fall, James A., Ronald T. Stanek, Louis Brown, and Charles Utermohle. 1996. *The Harvest and Use of Fish, Wildlife, and Plant Resources in False Pass, Unimak Island, Alaska.* Alaska Department of Fish and Game. Division of Subsistence. Technical Report No. 183. Juneau.

Fall, James A., Amy Paige, Vicki Vanek, and Louis Brown. 1998. *Subsistence Harvests and Uses of Birds and Eggs in Four Communities of the Aleutian Islands Area: Akutan, False Pass, Nelson Lagoon, and Nikolski.* Alaska Department of Fish and Game. Division of Subsistence. Technical Report No. 243. Juneau.

Finney, Bruce P., Irene Gregory-Eaves, Jon Sweetman, Marianne S.V. Douglas, and John P. Smol. 2000. *Impacts of climate change and fishing on Pacific salmon abundance over the past 300 years.* Science. Vol. 290.

Fitzgerald, Shannon, Kathy Kuletz, Mike Perez, Kim Rivera, and Don Dragoo. 2004. *Seabirds.* Appendix C: Ecosystem Considerations for 2005. North Pacific Fisheries Management Council Bering Sea/Aleutian Islands and Gulf of Alaska SAFE. NPFMC. Seattle.

Full Metal Minerals. 2005. Mining company website. http://www.fullmetalminerals.com/properties-portmoller.php

Gaichas, Sarah, Dean Courtney, Todd TenBrink, Mark Nelson, Sandra Lowe, Jerry Hoff, Beth Matta, and Jennifer Boldt. 2004. *Bering Sea Aleutian Islands squid and other species stock assessment.* Appendix C: Ecosystem Considerations for 2005. North Pacific Fisheries Management Council Bering Sea/Aleutian Islands and Gulf of Alaska SAFE. NPFMC. Seattle.

GAO (Government Accountability Office). 2004. *Individual fishing quotas: economic effects on processors and methods available to protect communities.* GAO-04487T. Website: http://www.gao.gov/docdblite/details.php?rptno=GAO-04-487T.

GAO (Government Accountability Office). 2002. Alaska's North Slope: *Requirements for restoring lands after oil production ceases.* GAO-020-357. Washington, D.C.

Gilpin, L. M., Carver, G. A., Knecht, R., and Knecht, P. 1994, Holocene seismic and

volcanic events recorded on the Kodiak Islands, eastern Aleutian Arc, Alaska, (abs), Geol. Soc. Am. Abstracts with Programs, Annual Meeting, v. 26, no. 7, p. 139.

Gilpin, L.M. 1995. *Holocene paleoseismology and coastal tectonics of the Kodiak islands Alaska:* unpub. Ph.D. dissertation, University of California Santa Cruz, 358 p.

Gretsch, Dennis. 2003. *KMA Commercial Herring Season Summary*. Memorandum, Department of Fish and Game, Division of Commercial Fisheries. Kodiak.

Gray, Glenn. 1990. Management of mixed stock salmon fisheries. Legislative Research Agency. Research Request 90.358. Juneau.

Harrington, Gretchen. 2002. *Biological Assessment for the BSAI Crab Fishery Management Plan.* National Marine Fisheries Service. Sustainable Fisheries Office. Juneau.

Haynes, Terry L., and Craig Mishler. 1991. *The subsistence harvest and use of stellar sea lions in Alaska*. Alaska Department of Fish and Game, Division of Subsistence. Technical Paper No. 198. Juneau.

Hiatt, Terry, Ron Felthoven, Chang Seung and Joe Terry. (2004) *Stock assessment and fishery evaluation report for the groundfish fisheries of the Gulf of Alaska and Bering Sea/Aleutian Island Area: economic status of the groundfish fisheries off Alaska, 2003.* Economic and Social Sciences Research Program. Resource Ecology and Fisheries Management Division. National Oceanic and Atmospheric Administration. Seattle.

Hubbs, C.L. and A.B. Rechnitzer. 1952. *Report of experiments designed to determine effects of underwater explosions on fish life.* In: California Fish and Game. Vol. 88, No. 2

Hutchinson-Scarbrough and James McCullough. Exxon Valdez Oil Spill Restoration Project Annual Report. Kametolook River Coho Salmon Subsistence Project Restoration Project 97247 Annual Report. Alaska Department of Fish and Game, Division of Subsistence. Kodiak

Ianelli, James N., Thomas K. Wilderbuer, and Terrance M. Sample. (2004) *Assessment of greenland turbot in the Eastern Bering Sea and Aleutian Islands*. North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

ISER (Institute for Social and Economic Research). 2005. Alaska Traditional Knowledge and Native Foods Database. University of Alaska. http://www.nativeknowledge.org/start.htm.

Joling, Dan. 2004. *Erosion reveals petrified trees*. Anchorage Daily News. August 2, 2004.

Knecht, Rick. 2005. Personal communication March 16, 2005.

Knecht, Rick; Davis, Richard, and Gary Carver. 2001. The Margaret Bay Site and Eastern Aleutian Prehistory. In: *Archaeology in the Aleut Zone of Alaska*, pp. 35-69. Don Dumond, Editor. University of Oregon Anthropological Papers 58.

Knecht, Rick, and Richard Davis. 2001. A prehistoric sequence for Eastern Aleutians. In: *Archaeology in the Aleut Zone of Alaska*, pp. 269-288. Don Dumond, Editor. University of Oregon Anthropological Papers 58.

Kruse, Gordon H., Fritz C. Funk, Harold J. Geiger, Kristin R. Mabry, Herman M. Savikko, and Shareef M. Siddeek. 2000. *Overview of State-managed Marine Fisheries in the Central and Western Gulf of Alaska, Aleutian Islands, and Southeastern Bering Sea with Reference to Steller Sea Lions.* Alaska Department of Fish and Game. Division of Commercial Fisheries. Regional Information Report 5J00-10. Juneau.

Kruse, Gordon H., Morgen Crow, Earl E. Krygier, Denby S. Lloyd, Kenneth W. Pilcher, Lorrie D. Rea, Michelle Ridgeway, Robert J. Small, Jay Stinson, and Kate M, Wynne. 2001. *A Review of Proposed Fishery Management Actions and the Decline of Steller Sea Lions Eumetopias jubatus in Alaska: A Report by the Alaska Steller Sea Lion Restoration Team.* Alaska Department of Fish and Game, Division of Commercial Fisheries. Juneau.

Lewbel, G.S. (ed). 1983. *Bering Sea biology: An evaluation of the environmental database related to Bering Sea oil and gas exploration and development.* LGL Alaska Research Associates, Inc. Anchorage, Alaska, and Sohio Alaska Petroleum Co., Anchorage.

Livingston, Pat, Ed. 2001. *Ecosystem Considerations for 2002*. Alaska Fisheries Science Center, Plan Teams for the Groundfish Fisheries of the Bering Sea, Aleutian Islands, and Gulf of Alaska. Seattle, WA.

Locher Interests Ltd. 1997. *Rural hydroelectric Assessment and Development Study Phase I Report.* Prepared for Alaska Department of Community and Regional Affairs. Division of Energy. Anchorage.

Lonner, Thomas D. 1980. *Subsistence as an Economic System in Alaska: Theoretical and Policy Implications.* Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 67. Anchorage.

Lowe, Sandra, James Ianelli, Harold Zenger, Kerim Aydin, and Robert Lauth. 2004. *Stock Assessment of Aleutian Islands Atka Mackerel.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle

MSSP (Market Segment Specialization Program). 1995. *Alaskan Commercial Fishing: Catcher Vessels Part I*. U.S. Department of the Treasury, Internal Revenue Service. Washington, DC.

Matthews-Amos, Amy; and Ewan A. Berntsen. 1999. *Turning Up the Heat: How Global Warming Threatens Life in the Sea*. Marine Conservation Biology Institute. Redmond, Washington.

Maynard, D.J. and D.D. Weber. 1981. *Avoidance of juvenile coho salmon (Oncorhynchus kisutch) to monocyclic aromatics.* Canadian Journal Fisheries and Aquatic Science 38:772-778.

Meehan, Rosa, Vernon Byrd, George Divoky, and John Piatt. 2002. Implications of ClimateChange for Alaska's Seabirds. Prepared for the U.S. Global Change Research Program, U.S. Geological Survey. Anchorage.

Mito, Kei-ichi, and Akira Nishimura and Takashi Yanagimoto. 1999. Ecology of Groundfishes In the Eastern Bering Sea, with Emphasis on Food Habits. Dynamics of the Bering Sea. University of Alaska Sea Grant. Fairbanks, Alaska.

NMFS/OPR (National Marine Fisheries Service/Office of Protected Resources). 2005. for Beluga Whale, Gray Whale, Steller Sea Lion, and Harbor Seal. Website for the Marine Mammals Management Commission. http://www.nmfs.noaa.gov/pr/PR2/Stock_Assessment_Program/individual_sars.html Accessed on multiple dates.

NMFS/RAMP (National Marine Fisheries Service/Restricted Access Management Program). 2005. *Report on Holdings of Individual Fishing Quota (IFQ) by Residents of Selected Gulf of Alaska Fishing Communities, 1995-2004.* Juneau.

NOAA (National Oceanic and Atmospheric Administration). 2005. Climate website. http://www.noaa.gov/climate.html

NPMAFC (North Pacific Fisheries Management Council 2005. Website http://www.fakr.noaa.gov/npfmc/

NSF (National Science Foundation). 2003. *Cumulative environmental effects of oil and gas activities on Alaska's North Slope.* National Research Council of the National Academies. National Academy Press. Washington, DC.

Otto, Bob, and Jack Turnock. 2004. *Bering Sea Crabs.* Appendix C: Ecosystem Considerations for 2005. North Pacific Fisheries Management Council Bering Sea/Aleutian Islands and Gulf of Alaska SAFE. NPFMC. Seattle.

Pacific Fisheries Environmental Laboratory. 2005. Climate Variability and Marine Fisheries. Website by National Oceanic and Atmospheric Administration. http://www.pfel.noaa.gov/research/climatemarine/cmffish/cmffishery.html. California.

Parsons Brinckerhoff. 2002. *Southwest Alaska transportation plan: An approved component of the Alaska Statewide Transportation Plan*. Prepared for the Alaska Department of Transportation and Public Facilities. Juneau.

Pautzke, Clarence G., and Chris W. Oliver. 1997. *Development of the Individual Fishing Quota Program for Sablefish and Halibut Longline Fisheries off Alaska.* North Pacific Fishery Management Council. Anchorage.

Peltier, W. R. 2001, Global Glacio Isostatic Adjustment and Modern Instrumental Records of Relative Sea Level History, in Bruce C. Douglas, Michael S. Karney, and Stephen P. Leatherman, eds, Sea Level Rise, History and Consequences, International Geophysics Series, v. 75, Academic Press, New York, p. 65-95.

Research Planning, Inc. 2001. *Coastal resources inventory and environmental sensitivity maps: Aleutians East Borough*. Columbia, South Carolina.

Rice, S.E. 1981. *Review: Effects of oil on fish*. National Academy of Sciences. Workshop on Petroleum in the Environment.

Schroeder, Robert F., David b. Andersen, Rob Bosworth, Judith M. Morris, and John M. Wright. 1987. *Subsistence in Alaska: Arctic, Interior, Southcentral, Southwest, and Western Regional Summaries*. Alaska Department of Fish and Game, Division of Subsistence. Technical Paper No. 150. Juneau.

Sealaska Heritage Institute. 2002. *Overview of Diversity of Ethnicity, Language, and Culture in Alaska with Recommendations for Economic Research and Development.* Juneau.

Sigler, Michael F., Chris R. Lunsford, Jeffrey T. Fujioka, and Sandra A. Lowe. 2004. *Alaska Sablefish Assessment for 2005.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Anchorage.

Sinclair, E., Ed. 2004. *Marine Mammals*. Appendix C: Ecosystem Considerations for 2005. North Pacific Fisheries Management Council Bering Sea/Aleutian Islands and Gulf of Alaska SAFE. NPFMC. Seattle.

Spencer, Paul D., James N. Ianelli, and Harold Zenger. 2004. *Pacific Ocean Perch.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Spencer, Paul D., James N. Ianelli, and Yong-Woo Lee. 2004. *Northern Rockfish*. North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Spencer, Paul D., and Rebecca F. Reuter. 2004. *Shortraker and Rougheye Rockfish.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Spencer, Paul D., Gary E. Walters, and Thomas K. Wilderbuer. 2004. *Flathead Sole.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Springer, A.M., J.A. Estes, G.B. van Vliet, T.M. Williams, D.F. Doak, E.M. Danner, K.A. Forney and B. Pfister. 2003. *Sequential Megafaunal Collapse in the North Pacific Ocean: An Ongoing Legacy of Industrial Whaling?* National Academy of Sciences. Washington, DC.

State of Alaska. 2002. *The status of Alaska oceans & watersheds 2002.* Report on a symposium held in Anchorage June 18-19 2002.

SWAMC (Southwest Alaska Municipal Conference). 2003. *Southwest Alaska Regional Economy.* Southwest Alaska Comprehensive Economic Development Strategy (CEDS), Anchorage.

Thorsteinson, L.K. (ed). 1984. Proceedings of a synthesis meeting: *The North Aleutian Shelf Environment and possible consequences of planned offshore oil and gas development.* Outer Continental Shelf Environmental Assessment Program. Juneau.

Thompson, Grant G. and Martin W. Dorn. 2004. *Assessment of the Pacific Cod Stock in the Eastern Bering Sea and Aleutians Islands Area.* North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Trites, Andrew W., and Villy Christensen and Daniel Pauly. 1997. *Competition Between Fisheries and Marine Mammals for Prey and Primary Production in the Pacific Ocean*. Journal of Northwest Atlantic Fisheries Science. Vol. 22, p. 173-187.

Trites, Andrew W. 1997. *The Role of Pinnipeds in the Ecosystem. Pinniped Populations, Eastern North Pacific: Status, Trends and Issues.* G. Stone, J. Goebel, and S. Webster, Eds. p. 31-39. A symposium of the 127th annual meeting of the American Fisheries Society. Boston.

Walker, D.; Weber, P.; Binnian, E.; Everett, K.; Lederer, N. Nordstand, E. and M. Walker. 1987. Cumulative Impacts of oil fields on northern Alaska landscapes. *Science*, November. 757-761.

Wilderbuer, Thomas K. and Daniel Nichol. 2004. *Yellowfin Sole*. North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Wilderbuer, Thomas K. and Terrance M. Sample. 2004. *Arrowtooth Flounder*. North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Wilderbuer, Thomas K. and Gary E. Walters. 2004. *Northern Rock Sole*. North Pacific Fisheries Management Council Stock Assessment and Fishery Evaluation. Seattle.

Wilson, Christopher D., Anne R. Hollowed, Michiyo Shima, Paul Walline, and Sarah Stienessen. 2003. *Interactions Between Commercial Fishing and Walleye Pollock*, Alaska Fisheries Research Bulletin, Vol. 10, No. 1. Juneau.

Wipfli, M. 1997. Terrestrial invertebrates as salmonid prey and nitrogen sources in streams: contrasting old-growth and young-growth riparian forests in southeastern Alaska, U.S.A. Can. J. Aquat. Sci: 54: 1259-1269

Wipfli, M, and D. Gregovich. 2002. Export of invertebrates and detritus from fishless headwater streams in southeastern Alaska: implications for downstream salmonid production. Freshwater Biology 47, 957-969.

Wipfli, M., J. Hudson, D. Chaloner, and J. Caouette. 1999. Influence of salmon spawner densities on stream productivity in Southeast Alaska. Can. J. Fish. Aquat. Sci. 56: 1600-1611.

Witherell, David, Nicole Kimball, and Jane DiCosmo. 2000. *Status and Trends of Principal Groundfish and Shellfish Stocks in the Alaska EEZ, 2001*. North Pacific Fishery Management Council. Anchorage.

Wolfe, Robert J. 2004. *Local Traditions and Subsistence: A Synopsis from Twenty-Five*

Years of Research by the State of Alaska. Alaska Department of Fish and Game, Division of Subsistence. Technical Paper No. 284. Juneau.

Wolfe, Robert J., 1996, *Subsistence Food Harvests in Rural Alaska, and Food Safety Issues.* Alaska Department of Fish and Game, Division of Subsistence. Paper presented to the Institute of Medicine, National Academy of Sciences, Committee on Environmental Justice, 1996, Washington, DC.

Wolfe, Robert J., 1993. *The subsistence harvest of harbor seal and sea lion by Alaska Natives in 1992, Parts 1 and 2*. Alaska Department of Fish and Game, Division of Subsistence. Technical Paper No. 229. Juneau.

Wolfe, Robert J., and Craig Mishler. 1993. *The Subsistence harvest of Harbor Seal and Sea Lion by Alaska natives in 1992.* Alaska Department of Fish and Game. Division of Subsistence. Technical Paper No. 229 Part 1 and Part 2. Juneau.

Wolfe, Robert J., Amy W. Paige, and Cheryl Scott. 1990. *The Subsistence Harvest of Migratory Birds in Alaska.* Alaska Department of Fish and Game, Division of Subsistence. Technical Paper No. 197. Juneau, 1990.